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ABSTRACT

This handbook was designed to help adult literacy education teachers to understand the plastics industry, develop a curriculum, and teach basic skills classes in a plastics company. The book contains four main sections. The first section, on the basics of plastics, contains a brief history of the industry, an elementary description of the processes and materials used, and information on environmental and safety issues related to the plastics industry. The second section provides some ideas for developing curriculum materials and some samples that can be adapted. In the third section, comments from workplace educators detail what has and what has not worked in the workplace. This section covers not only curriculum design but also many aspects of the workplace. The final section, a glossary, contains definitions of terms that are encountered in the plastics industry. The materials are illustrated with line drawings. An appendix section outlines the workplace education program at NYPRO, Inc. (Contains 11 references.) (KC)

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PLASTICS

A Handbook for Workplace Educators

Developed and Written by
Donna Curry and Mikki Smith

Funded by the Massachusetts Department of Education
in Collaboration with the North Central Regional Employment
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ACKNOWLEDGMENTS

We could not have written and produced this book without all the advice and support we received.

First, we want to thank the Massachusetts Department of Education and the Workplace Education Initiative duo, Johan Uvin and Bob Bozarjian, for their feedback, guidance, and trust that this project could be completed by the deadline.

Second, our sincerest thanks to our technical resource, Michael Goderre. He provided us with a wealth of information, explanations, and drawings which allowed us to become "plastics literate". Thanks, Mike, for your help!

We want to thank workplace educators Nancy Erb, Rosa Maria Ricci, and Jennie Morris for their ideas and input. A special thanks goes to Jeannette Hoessel who provided us with samples of her curriculum and took the time to "spell it out for us".

Last, but definitely not least, we would like to thank the North Central Regional Employment Board for its foresight in determining there is a need for workplace education in the plastics industry; we appreciate the opportunity to contribute to their vision. Thanks, Phyllis Lary and Rosemary Lamacchia!

*Donna Curry
Mikki Smith*

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PREFACE

As an ESL/ABE teacher entering a workplace program in a plastics company, it is essential that you are as familiar with the company, its product, and its language, as you are with the theories and practices you will employ teaching your students. The goal of this book is to provide you with information which will assist in making you "plastics literate" and to help you become a more effective workplace educator.

Many of the processes and much of the terminology are highly technical and at a level far above what you or your students will encounter. However, if you have a basic understanding of the specific terminology and issues as they relate to the plastics industry, you can then adapt your materials and methods to better meet the needs of the company and the students.

Workplace research has validated the theory that skills learned in a functional context are more concrete and retained for a longer period of time than those presented in a traditional school-based or generic approach.

We have broken this book into four main sections:

- The Basics of Plastics
- Curriculum Development
- What Has Worked and What Hasn't
- Glossary

In the section on the basics of plastics we have provided you with a brief history of the industry, an elementary description of the processes and materials used, and information on environmental and safety issues as related to the plastics industry.

In the curriculum section we have provided you with some ideas to use to help you create your own curriculum materials, as well as some samples that you can adapt for your own situation.

In the section titled "What Has Worked and What Hasn't", we included comments from workplace educators about what has and hasn't worked in the workplace. This section is not just limited to curriculum design but covers many aspects of the workplace.

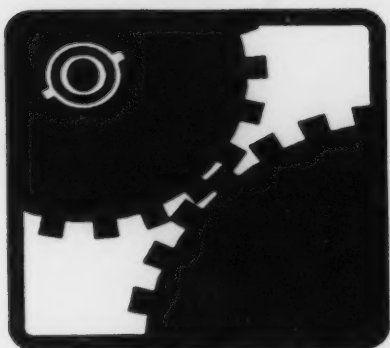
In the Glossary we have given you definitions of terms you may encounter in the plastics industry. Our goal is for you to use this as a resource as you learn about your own plastics workplace.

SPECIAL NOTE:

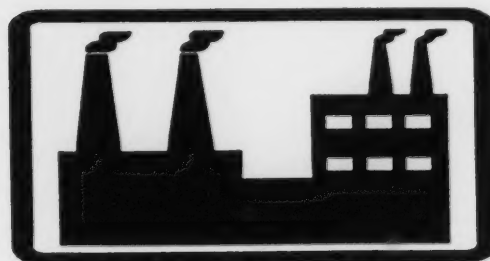
The view expressed in this book are not necessarily those of the Bureau of Adult Education or the North Central Regional Employment Board.

If you would like support in initiating your own workplace curriculum, please feel free to contact either one of us at (508) 939-5282, Curry Consultants, 28 Shady Lane, Templeton, MA 01468. We would appreciate hearing comments from you regarding materials presented in this book.

*Donna Curry
Mikki Smith*



The Basics of Plastics



BRIEF HISTORY OF PLASTICS

Plastics are synthetic materials that can be formed by heating, milling, molding, or similar processes into usable products. The word comes from the Greek word, "plastikos" which means "to form." Plastics are composed of chains of giant molecules (polymers). It is this molecular structure which allows most plastics to be softened but not melt when heated, and then be reshaped into rigid new forms under mechanical stress without losing cohesion.

Alexander Parkes exhibited the first plastic, called Parkesine, in 1862. A printer from Albany, New York, John Wesley Hyatt, is generally considered as the father of the plastics industry. In 1868, he formulated the first commercial plastic material in the United States, Celluloid. The substance was used as a substitute for ivory in billiard balls. In 1909, Dr. Leo H. Baekeland, a Belgian chemist, developed phenolic plastic, called Bakelite. It was used to make bobbin ends, auto ignition parts, electrical insulators, and distributor caps. In 1914, the Eastman Kodak Company began using it for camera parts. In later years even Hyatt used Bakelite in his billard balls.

Coal, oil, wood and milk have provided "waste products" which have been converted into useful plastics. Most of the plastics in production today have as their sources breakdown products (waste products) from the destructive distillation of oil and coal. In other words, the wasted by-products in the process of converting crude oil to usable products can be used as a source for creating plastic. Nylon, Bakelite, polyurethane, and fiberglass owe part of their existance to coal; whereas, PVC and polythene would not exist if not for oil.

POSITIONS IN PLASTICS

There are a wide variety of jobs performed in the plastic industry with skill levels ranging from minimally skilled to highly skilled. In the past many of these positions required no experience or training; but today, as a result of technological advances and the implementation of quality initiatives, workers in all areas need training previously not considered essential. To give you a sense for the types of jobs and the duties involved, the following is a brief overview of some jobs.

FINISHERS and ASSEMBLERS

Plastic parts and products sometimes require hand or machine finishing and many need assembling. Finishing may be done by the machine operator or it may be done in the finishing department. Assembler's duties include putting on handles, knobs, or the like. Plastic parts are assembled by spin welding, cementing, ultrasonic welding, or staking. Finished parts or assemblies are often packed for shipment on the assembly line. Before companies instituted quality efforts which required that all workers be proficient in monitoring quality, little or no previous experience or training for finishers and assemblers was necessary.

FLOOR WORKERS and MATERIAL HANDLERS

These, too, were entry level positions requiring little or prior experience. Now these positions require skills in problem-solving and communication. Since molding machines operate continuously and the need for materials is constant, these positions require shift work. Lifting and carrying are necessary since a material handler may be required to move a 50 pound bag of plastic material.

MACHINE OPERATORS

Machine operators run the molding and forming machines used in the plastics industry. They usually learn their jobs by doing them. They learn to operate the production machines in the plant. They make only a certain part, but when a new part is set up, the operator must learn the new duties. They often are responsible for the quality of their molding machine products which requires visual inspection. In the past operators seldom adjusted their machines. This was assigned to supervisors, trouble-shooters, or cycle analysts. Now, operators are being asked to accept new responsibilities: to adjust machines when

they are no longer in control, or to decide whether an assembly line needs to shut down because of a faulty machine. This requires skills in critical thinking and communication.

MOLD SETTERS and MAINTENANCE MECHANICS

Machine adjustments are usually made by set-up workers, cycle analysts, maintenance workers or trouble shooters. Job titles vary from plant to plant, as do job functions. Workers in these jobs generally use a variety of hand and power tools. They must understand the molding process and their assigned machines. They must be good plumbers, electricians, and mechanics.

Set-up workers are responsible for setting a machine up and adjusting it for correct operation. Ability to understand and follow directions written by production engineers for cycle times, temperatures, and pressures is required. Generally they are experienced machine operators and receive on-the-job training for new assignments. It is necessary that these workers possess effective reading, math, and communication skills.

DIE and TOOL MAKERS

In the plastics industry these are called mold makers. They are skilled metalworkers and usually do not work in the plastics plant. They work with equipment that is extremely exact, building and repairing molds. Since accuracy and specific skills are required, they receive special training either through apprenticeship programs or through vocational or technical schools.

Today, companies are finding that special training before taking a position is not enough. All workers need continual training in order to keep up with the latest technologies.

PRODUCTION and DESIGN ENGINEERS

Production engineers design the molds and make plans for molding a part or a product. They work closely with the design engineers who have designed the product. Unless there are non-native English speakers, it is doubtful that you will see these employees in your workplace education classroom.

As with any industry there are hundreds of positions in the plastics industry. We have only listed a few which are characteristic of the industry to familiarize you with some of the positions your students may hold, or want to hold in the future.

TYPES OF MATERIALS

There are two major categories of plastics: thermoplastics and thermosetting.

THERMOPLASTICS



Thermoplastics act like candle wax when heated or cooled.

Thermoplastics act like candle wax or ice. They make a physical change when heated from solid to liquid, then cooled from liquid to solid. The physical change occurs twice during the molding cycle. Thermoplastics may be softened and hardened many times. The plastics industry recycles scrap thermoplastics. Too much heat can degrade thermoplastics. Examples of thermoplastics are polyethylene, PVC, polycarbonate, polystyrene, Teflon, or nylon.

* polyethylene - one of the softest plastics



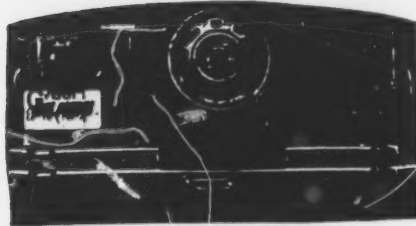
- > detergent bottles
- > bread wrappers
- > toys

* PVC - one of the most widely used plastics



- > lightweight raincoats
- > shower curtains
- > hoses, pipes
- > rigid gutters
- > trays in boxes of chocolate candies

* polycarbonate - one of the highest impact strengths of all plastics



- > taillight lens

* polystyrene - a foamed plastic... Styrofoam



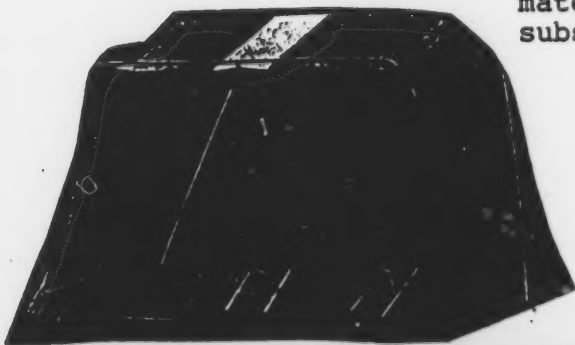
- > ice buckets
- > drink cups
- > coolers

* Teflon - a fluorocarbon plastic low in friction - slippery



- > Teflon coated fry pans

* nylon - the first plastic to be discovered as a result of planned research - to find a material which could be used as a substitute for silk



- > clothing
- > backpacks
- > tents

THERMOSETTING

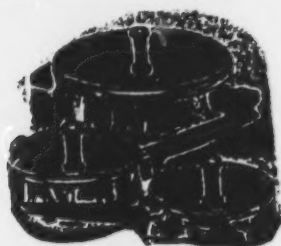
Thermosetting plastics are cured or set into permanent shape during molding. Heat or pressure and heat cause a permanent chemical change. Thermosetting plastics cannot be recycled or softened. They can be degraded by subjecting them to extremely high temperatures or by cutting or breaking. Epoxy, phenolic, and thermoset resins are examples of thermosetting plastics.

- * epoxy - the most outstanding characteristic is its ability to form strong adhesive bonds



> epoxy glue

- * phenolic - a hard and stiff plastic



> pot handles

> auto distributor caps

> washing machine agitators

- * thermosetting resins - plastics which will take extreme temperatures both hot and cold

> Silicone

> Bakelite

> Formica



Thermosetting plastics act like concrete when set.

TYPES OF PROCESSES

Plastic material may be compressed in a mold or die during the molding process. It is formed or finished under pressure. There are several examples of the molding process: injection molding, blow molding, compression and transfer molding, extrusion, vacuforming, and fluidized bed molding. The following is a brief description of these processes and examples of what items may be produced.

BLOW MOLDING

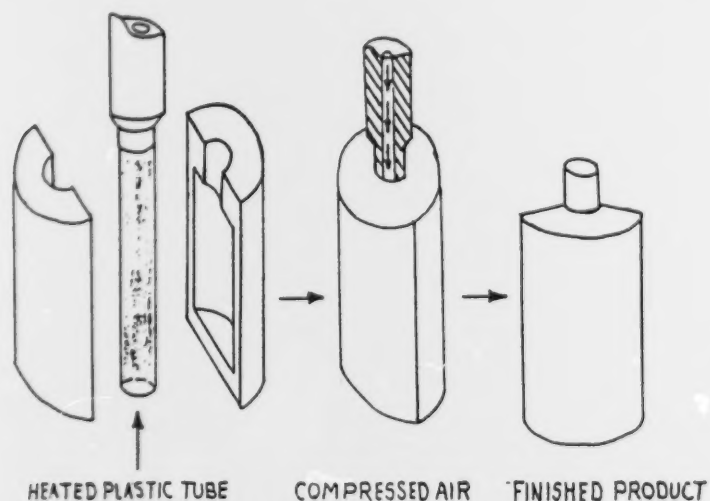
This process is used for forming hollow objects from thermoplastics. Products such as bottles, garbage cans, and toys are common. Three methods of blow molding are:

- > direct method
- > indirect method
- > injection method



Blow molding provides a quick method of processing bottle-like containers with open ends. The scrap plastic is recycled.

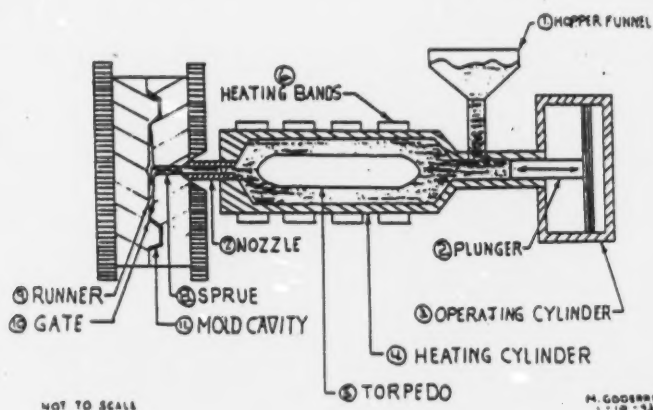
THE BLOW MOLDING PROCESS



INJECTION MOLDING

Hot, melted plastic is pushed into a closed mold. The material is cured or hardened in the mold. Both thermoplastic and thermosetting plastics can be injection molded. There are basically two types of injection molding: plunger injection and screw injection molding.

PLUNGER INJECTION MOLDING



a. Plunger injection molding (sometimes called ram injection) is an older type. Plunger injection molders mold all types of thermoplastics.

- Thermoplastic material is placed in the hopper funnel (1). It is dropped by gravity into the feed throat.
- The plunger (2) pushes it forward.
- The operating cylinder (3) moves the plunger back and forth and the plastic material is moved into the heating cylinder (4). It is pushed against the walls of the cylinder by the torpedo (5). The cylinder is usually heated by heater bands (6) and the plastic is heated as it passes between the torpedo and the heated cylinder walls.
- The hot plastic goes through the nozzle (7) which is tightly fitted against the sprue (8). The sprue carries the plastic into the mold.
- The hot plastic then flows through the runners (9) and the gate (10) into the mold cavity (11).

The plastic cools and hardens in the mold under pressure. The mold is then opened and the part is pushed out. The product of one injection molding cycle is called a shot.

b. Screw injection molding is similar to the plunger injection molding with the main difference being in the heating cylinder. In the screw injection molding plastic is heated by friction in addition to the heating bands in the cylinder. This is probably the most widely used plastics process.

- The plastic is fed by gravity from the **hopper funnel** (1) into the **cylinder** (2).

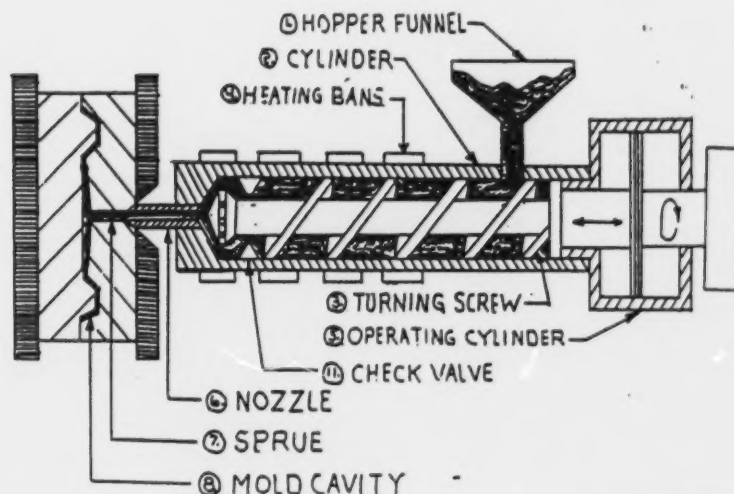
- A turning **screw** (3) moves the plastic forward. This causes frictional heat in the plastic.

- Electric **heating bands** (4) heat the outside of the cylinder. The heat melts the moving plastic. The plastic moving forward pushes the screw backward and plastic builds up ahead of the screw. The screw stops when there is enough plastic built up.

- The screw is then pushed forward by the **operating cylinder** (5). This injects the plastic. A **check valve** (6) is on the front of the screw. It keeps the plastic from sliding backward during injection.

- The plastic flows through the **nozzle** (7) and **sprue** (8). It then enters the **mold cavity** (9) where it cools. Meanwhile, more plastic is heated by the turning screw. The mold opens after the screw stops turning, the part is pushed out, and the process is repeated.

SCREW INJECTION MOLDING



NOT TO SCALE

M. GODERRE
1-10-93

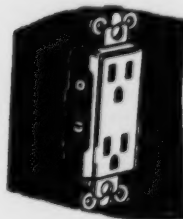
COMPRESSION and TRANSFER MOLDING

This process compresses plastic materials into shape. The materials are cured or hardened in a metal mold. Both thermoplastics and thermosetting plastics can be molded.

Common products made by compression molding are:

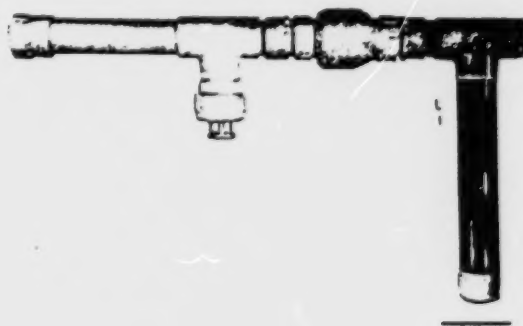


toaster handles
light switch cover plates
plastic dishes
pot and pan handles
distributor caps
electric switch parts



EXTRUSION MOLDING

In the extrusion process plastic materials are heated and pushed forward by turning a screw. The materials are forced through an opening called a die. The die shapes the plastic. Extrusion is a continuous process designed to convert plastics into pipes, films, rods, fibers, sheets or shaped profiles. Extrusion is a very versatile process used for production of bottles and other hollow objects, covering paper, and other materials with a thin plastic coating.

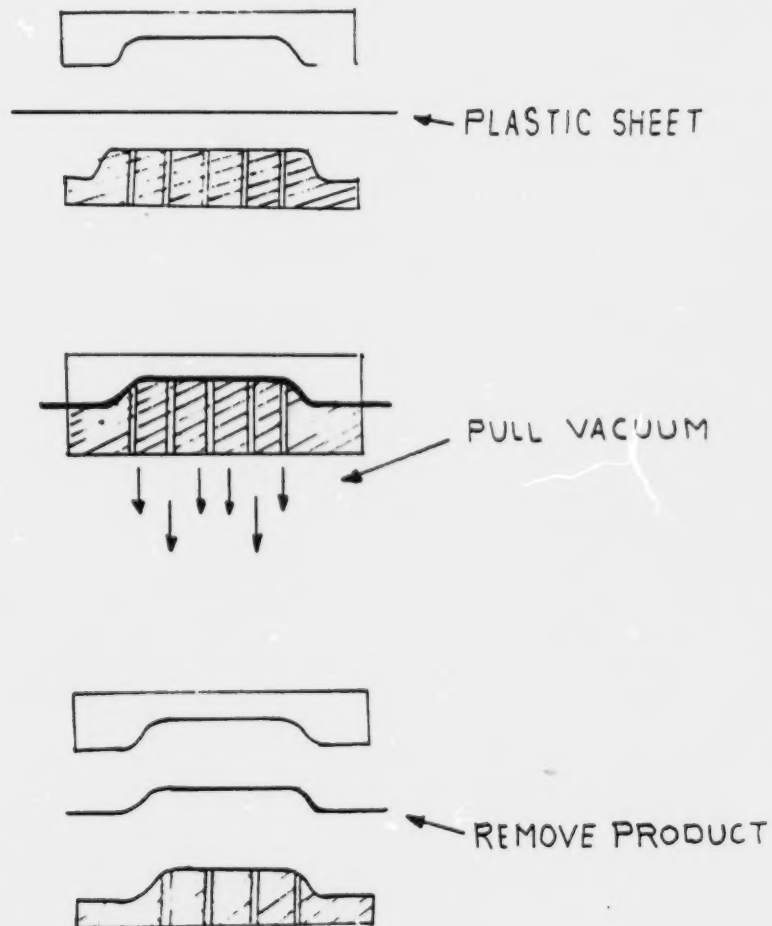


VACUFORMING

This a method of *thermoforming*. Thermoforming plastics processes use a heated plastic film or sheet. The film or sheet is formed over the mold. It hardens as it cools on the mold and will hold the shape of the mold.

Examples include blister packages and skin packaging.

THE VACUFORMING PROCESS

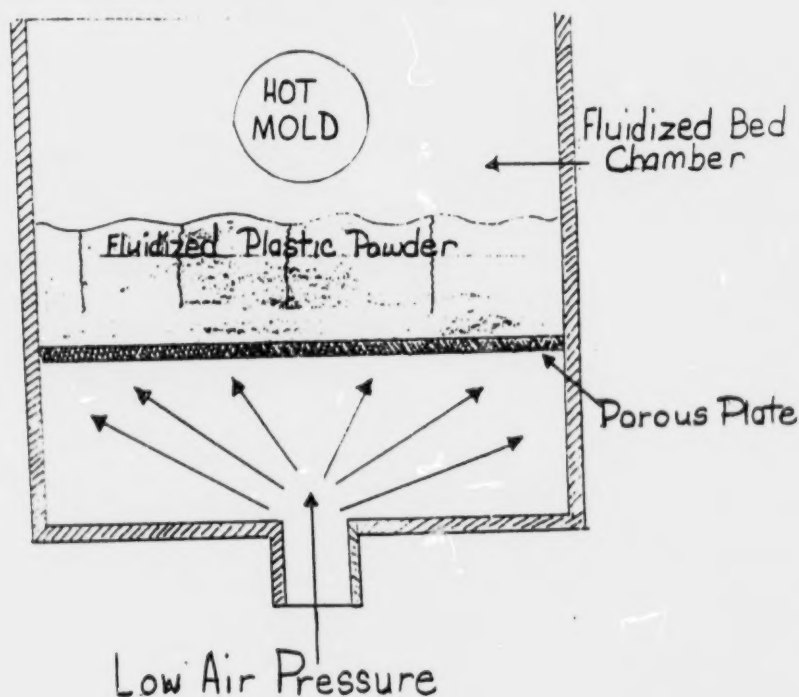


FLUIDIZED BED COATING

This is one of the secondary processes used to place a thin coat of plastic over a product to provide a protective finish. Secondary processes include operations such as construction, bonding, fastening, finishing, decorating, and coating. These are generally finishing processes. Various methods are used, fluidized bed coating being one of them.

Fluidized bed coating uses dry powdered plastic materials to coat heated objects or molds. The dry powder will 'float' over the air and act like a liquid which coats the hot mold. The molded object is then removed from the bed chamber and placed in an oven where the heat smooths the coated plastic surface.

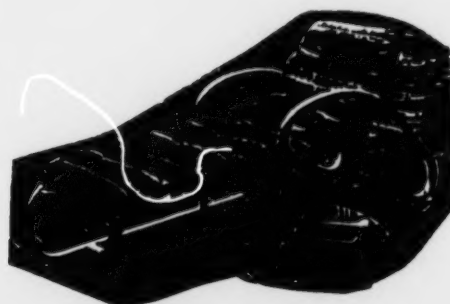
Fluidized Bed Coating



NOT TO Scale

M SMITH
1-16-93

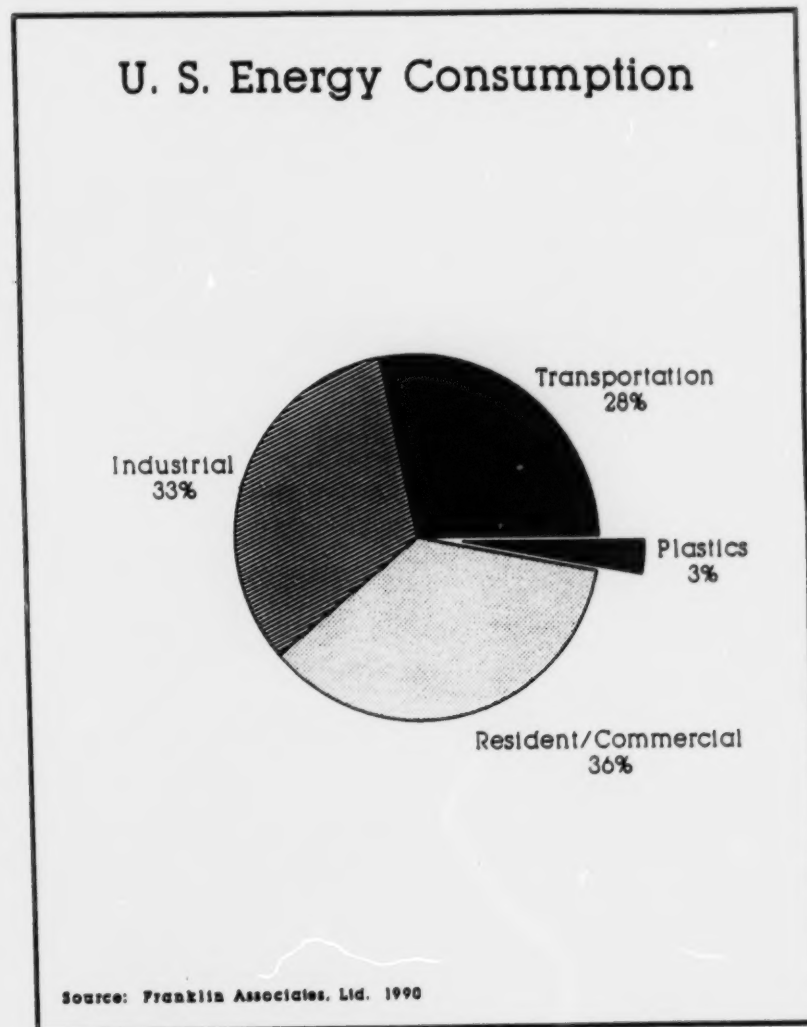
Metal lawn furniture is frequently fluidized bed coated because the plastic coating is more durable than paint.



ENERGY, THE ENVIRONMENT, RECYCLING, and SAFETY

ENERGY

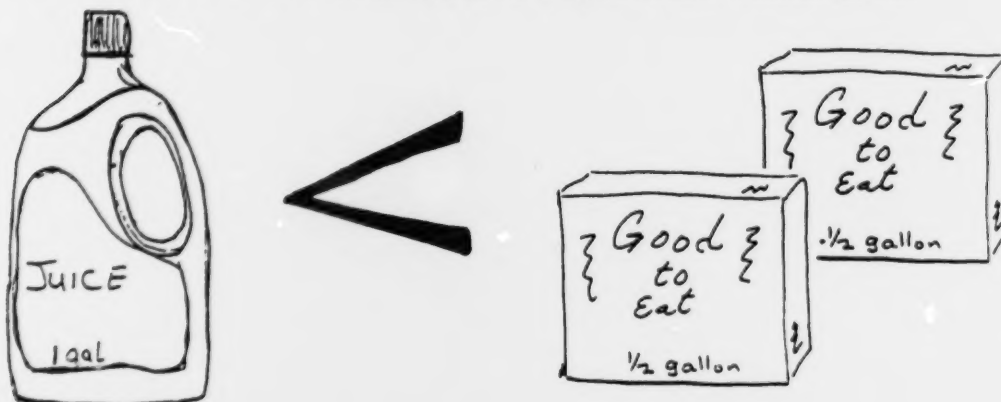
Plastics are derived from oil and natural gas, leading some to question whether plastics are an effective use of these resources. The answer can be found by comparing the energy used to manufacture, use and dispose of plastic products with equivalent products made from other materials. A total of three percent of total energy consumption in the United States is related to plastics.



ENVIRONMENT

Most plastics do not biodegrade, which often leads to the assumption that plastics are a problem in landfills. Modern sanitary landfills are designed to seal out the air and moisture needed for biodegradation to take place. In fact, excavations have turned up newspapers that were still legible and vegetables that were still recognizable - even after decades in a landfill. It is assumed that paper packages are more environmentally friendly than plastics. However, plastic packaging often produces less waste - from manufacture to ultimate disposal or reuse - than comparable paper packages.

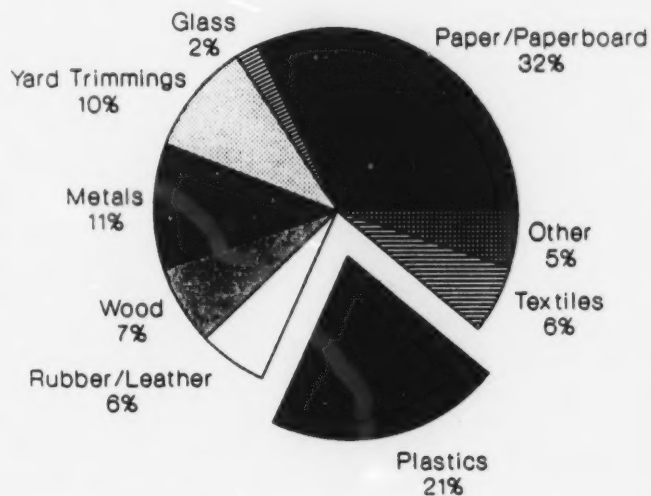
For example, a one-gallon juice jug results in 220% less air emissions, over 400% less waterborne waste, and 9 to 12% less solid waste than two half-gallon paperboard containers.



Landfills control biodegradation because explosive gases and groundwater contamination can result from uncontrolled degradation on such a large scale. Since plastics are inert, or incapable of degrading, they do not contribute to these potential hazards. Enhanced degradability is being incorporated in some products which are potentially more susceptible to littering. For example, the six-pack loop connector is now being made with special photodegradable plastic (these special plastics are marked with a diamond shape). Responding to the widespread concern over the impact of CFC's (Chlorinated Fluorocarbons) on the Earth's ozone layer, polystyrene foam food service manufacturers voluntarily switched to other foaming agents in 1988.

Most plastics can withstand exposure to the elements without losing their strength and protective qualities. However, the current concern over America's waste management situation has raised questions about plastics' environmental compatibility. The Environmental Protection Agency estimates that plastics make up 21% of landfilled wastes by volume. Paper and paperboard, by contrast, make up 32% of total landfill volume.

Materials in Municipal Solid Waste by Volume



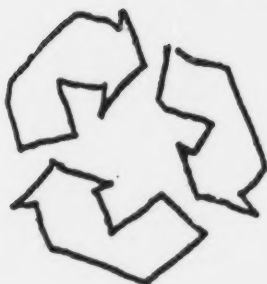
Source: 1993

U. S. Environmental Protection Agency

RECYCLING

Over the past several years, recycling has become a way of life for millions of American families eager to do their part to protect the environment. Recycling can conserve valuable natural resources, and it also is a key element of integrated waste management - the Environmental Protection Agency's (EPA) solution to our nation's solid waste disposal problems.

An ever increasing variety of products - from toys to carpets - are being made with recycled plastic content.



- * the plastic used in soft drink bottles is being made into new bottles, fiberfill, and carpeting
- * the resin used in milk, juice, and water jugs is being used to make new consumer product bottles, plastic bags, and recycling bins
- * recycled polystyrene is used to make office accessories, cafeteria trays, video cassette cases, and even insulation

Durable goods, cars, appliances, computers, etc., make up 23% of landfill wastes. The plastics industry is taking steps to increase the recovery and recycling of plastics used in these products. For example, car batteries are easily removed and more than 95% currently are recycled for their plastic and lead components.

Waste and scrap plastic are disposed of in one of three ways:

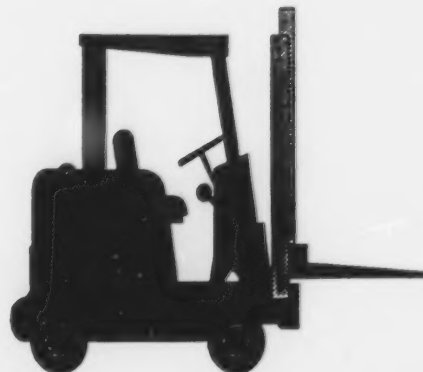
- > Primary: Regrind. Grinding of scrap parts for reuse in one of the original processes (can be as much as 25% in some jobs)
- > Secondary: Sale of scrap parts and regrind. Those parts that are unable to be reused in the original process
- > Thirdly: Shipment of contaminated plastic and machine purgings that are unable to be recovered by primary or secondary recycling. These materials are sent to facilities where they blended into a waste-derived fuel for burning in cement kilns.

About 14% of all plastics were recycled in 1991, up from 9% the year before. Plastic soft drink bottles, the most recycled plastic containers, were recycled at a rate of 35% versus 30% in 1990. The American Plastics Industry has set a goal of recycling the equivalent of 25% of all rigid plastic bottles and containers by the end of 1995.

As a teacher it is your responsibility to discover what your company is doing to meet the recycling issues. In fact, you may find that the company you are in is not only deeply committed to recycling its own products, but has an aggressive program within the workforce to recycle cans, paper, etc.

SAFETY

As with any manufacturing plant, there are a multitude of safety issues that must be addressed. Within the plastics industry there are potential dangers everywhere. The danger of burns, excessive noise, fire, strains, falls, explosions, contamination, and poor ventilation. Again, it is strongly recommended that you talk to plant safety personnel to discover what particular issues are pertinent to your workplace. Some safety issues may be



- > gloves
- > ear plugs
- > clean area
- > safety garments
- > goggles

In 1976 the U.S. Congress added the Medical Device Amendments to the Federal Food, Drug and Cosmetic Act and authorized the FDA to establish and enforce GMP (Good Management Practices) regulations for medical devices. FDA (Food and Drug Administration) inspectors can cite or even shut down a company that is not adhering to its regulations. With this in mind, it would be beneficial to the program for teachers to make contact with the Quality Assurance or Quality Control department to learn about any specific rules and regulations your students need to be adhering to or be made aware of. These then can be used to enhance your curriculum materials and can provide a wealth of information. We have included sample curriculum ideas in the Curriculum Development section.

EVERYDAY OBJECTS

We may not realize how plastics effect our everyday lives. Below we have listed for you an outline of some of the everyday items you use and the plastic which is primarily used to produce that item.

On the left side we have listed the familiar household item and on the right the plastic most often associated with it. This information can be used in oral vocabulary exercises with ESL students and with ABE students to familiarize them with the written names of items with which they are familiar. Activities such as alphabetizing or classifying (where items may be found in a house, or items which would be located outside of the house), or discussing similarities and differences in items can be used. Students could bring in pictures of various items and do a plastics bulletin board.

<u>HOUSEHOLD ITEM</u>	<u>PLASTIC</u>
Adhesives	
Plastic cement	silicone
Two component cements	polystyrene
White glue	PVAC
Appliance Housings	ABS, polystyrene
Bathtub and shower enclosures	polyester, fiberglass
Bottles	
Translucent, opaque	polyethylene, polypropylene
Clear	PVC, polyester
Buckets	polyethylene, polypropylene
Countertops	
Surfacing	phenolic/melamine (Formica)
Cushions, pillows, and mattresses	polyurethane foam, PVC foam
Dishes	Melamine (Melmac)

**Interior of dishwashers and
washing machines**

polypropylene

Drink containers

Clear and rigid
Flexible
Insulated cup

polystyrene
polyethylene
polystyrene foam
(Styrofoam)

Electric circuit boards

Switch toggles

phenolics

Fillers

Caulking compounds
Patching kits
Spackling compound

polyurethane, PVAC
polyester
PVAC

Films

Food wrap

polyethylene,
polypropylene,
PVDC (Saran Wrap)
polyester
cellulosics

Magnetic tape
Photo film

Flooring (Sheet or tiles)

PVC

Furniture

Clear
Flexible
Glossy and opaque
Upholstered

Acrylic (Lucite)

ABS, polyester
PVC (Naugahyde)

Garden Hoses

PVC

Gutters and Downspouts

ABS, PVC

Handles and Knobs

Clear
Black, pots & pans

Acrylic, cellulosics
phenolics

Insulation foams

Preformed
Foamed in place

polystyrene
polyurethane

Lighting

Fixtures
Shades, diffusers

phenolics
Acrylic, cellulosics
polycarbonate

Lubricants

silicone

Paints

Ceramic and glass
Masonry

Metal
Plaster, wallboard

epoxies, polyurethane
Acrylics, epoxies,
PVAC
epoxies, phenolics
Acrylic, polyester

PVAC

Plastic
Tool handles
Wood

polyester
PVC/PVAC
Acrylic, polyethylene,
PVC

Plumbing pipes

ABC, polyethylene, PVC

Roofing

Patio Covers

polyester

Siding and paneling

PVC

Telephone housing

ABS

Toys

Glossy and opaque
Flexible

Clear and hard
Tubing

ABS, polystyrene
polyethylene,
polypropylene
polystyrene
PVC, polyethylene

Wallpaper

polyester, PVC

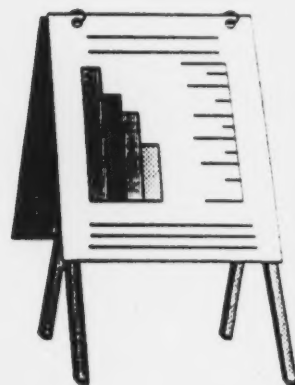
Window frames

PVC

Windowpanes, skylights,
clear panels

Acrylic, polycarbonate

Source: Working with Plastics



Curriculum Development



WHERE TO BEGIN

You now know "all" about the plastics industry. So now what? Where do you begin with curriculum development? How do you incorporate this plastic information into your daily teaching? The following information should give you some idea as to where to begin (By the way, these steps are not specific to the plastics industry, but are worth following no matter what the industry or workplace program):

> *Familiarize yourself with the company*

Learn the structure

- . What is the hierarchy?
- . Who reports to whom?
- . What are the different organizations or departments?

If the company has a Personnel or Employee Handbook, make sure you have a copy - and READ !!!

Find out what kind of products the company makes

Find out size of the company

- . Does it operate in the international arena?
- . Is it family owned and operated?
- . Is it only local?

> *Familiarize yourself with the industry*

Learn what the various processes are

- . Are there different manufacturing processes involved?
- . What are the steps from receiving the raw materials to shipping the finished product out the door?

Research and become familiar with the specialized vocabulary used by the industry

- . Does the company have its own "language"?
- . Does it use acronyms? Abbreviations?

Once you have done your own research on the company and the industry:

- > *Make a list of any questions you don't understand or want further clarity on*

- > *Seek and gain permission to visit at the worksite*

Observe your surroundings

- . What kind of reading materials are around the worksite? - Are there safety signs, instructions, personnel handbooks?
- . Are there any charts or graphs posted?
- . What kind of communication is going on between co-workers? Between workers and supervisors?

This doesn't mean to ask for a 'tour' of the facility - rather, you want to take time to observe the workers, listen to conversations, pay attention to the types of skills being applied.

- > *"Befriend" the personnel or training manager*

Find out what issues the company is presently dealing with

Ask for a copy of the company's vision statement and goals

Ask about the company's perceptions and expectations of the workplace program

All of the above activities should occur before classes ever begin.

- > *Evaluate the present functioning level of your students*

This can be done informally - either observe students as they perform their jobs or create an informal inventory based on what you noted while at the worksite.

- > Compare your students present functioning level to the company's goals and expectations

Create your curriculum so that it matches the students' present functioning level but is designed to help the students work toward achieving the company's goals and expectations*

The difference between where they are now and where the company would like for them to be is called the 'delta' - noted by a Δ . This difference is what helps you determine your curriculum.

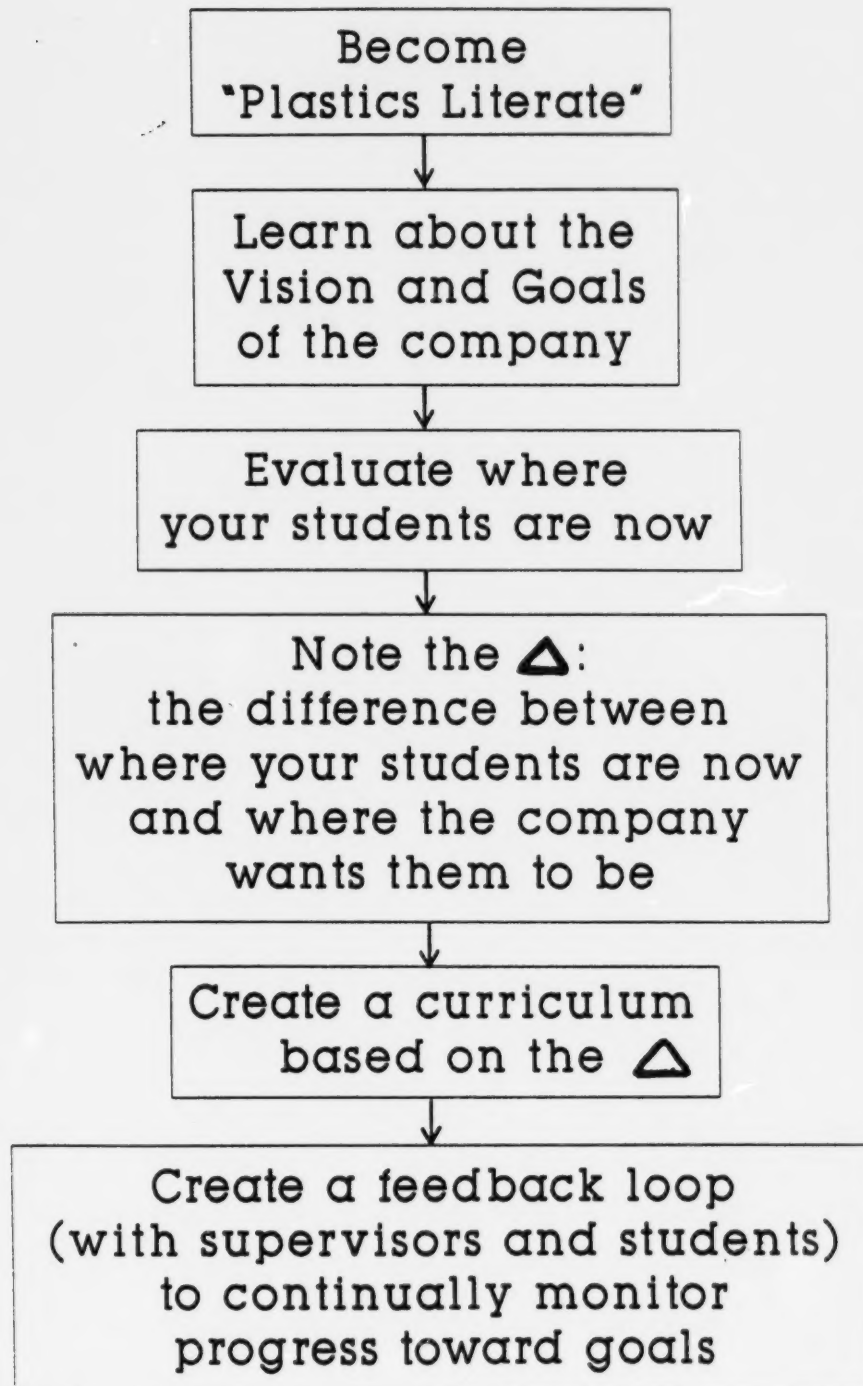
As you begin to design your curriculum,

- > Form a team that includes supervisors, students, and key individuals - maybe from the personnel or quality department.

Meet periodically to continuously monitor, evaluate, and revise the curriculum to meet the ever-changing demands of the business.

- * In the Appendix is an example from one workplace company on how the company and the workplace education program have worked together to address this issue

Where to Begin



COMMON TERMS

We have already given you some basic information on plastics. You could garner a list of vocabulary based on that information, just as you could if you observed work being done at the worksite. To help you out, though, we have provided you with several vocabulary lists to get you started.

To teach and reinforce terms from lists such as the following:

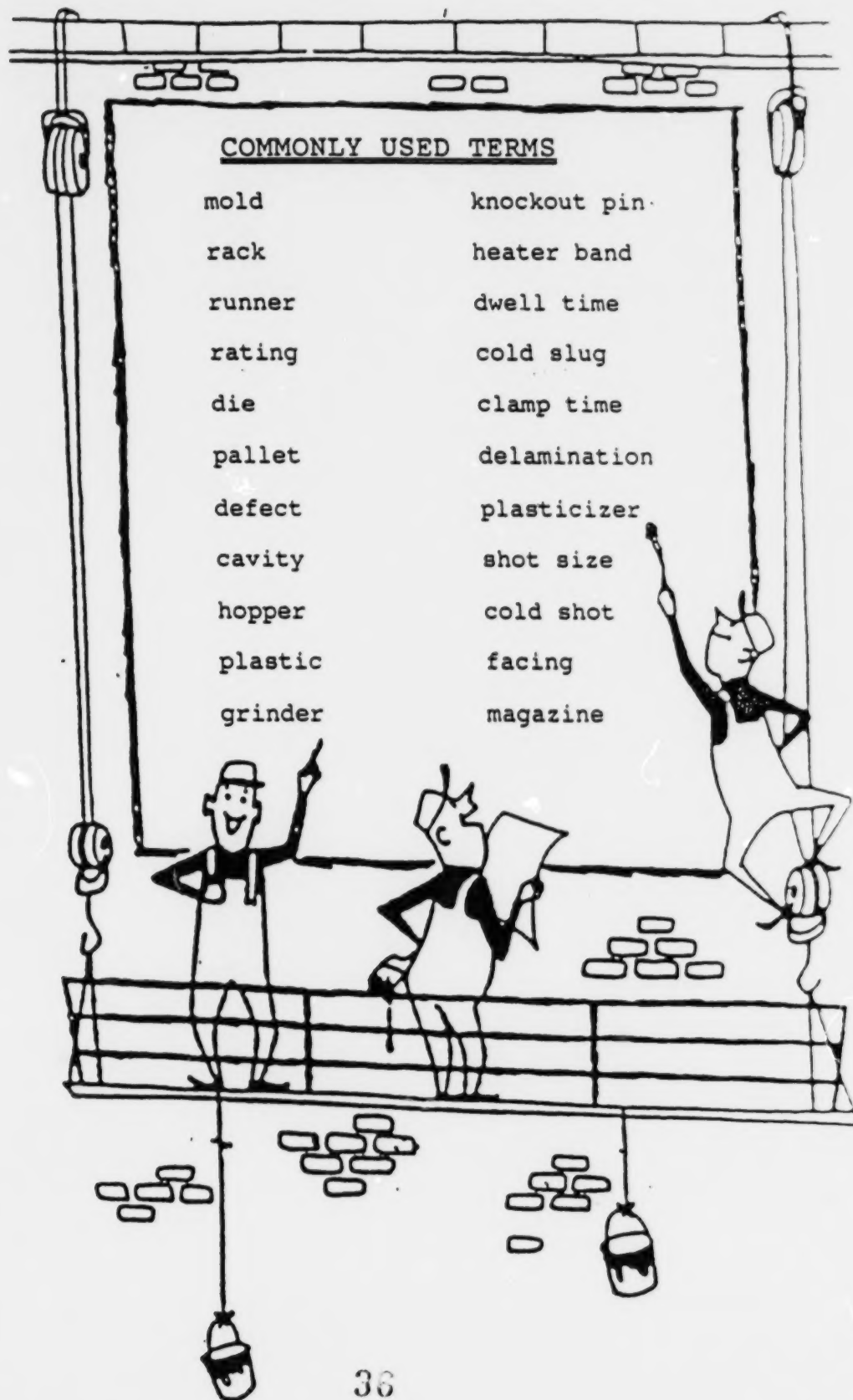
- > "Everyday Objects" (pages 18 - 20)
- > "Commonly Used Terms" (page 26)
- > "Common Defects" (page 27)

you can create your own materials such as puzzles, games, and oral and written activities.

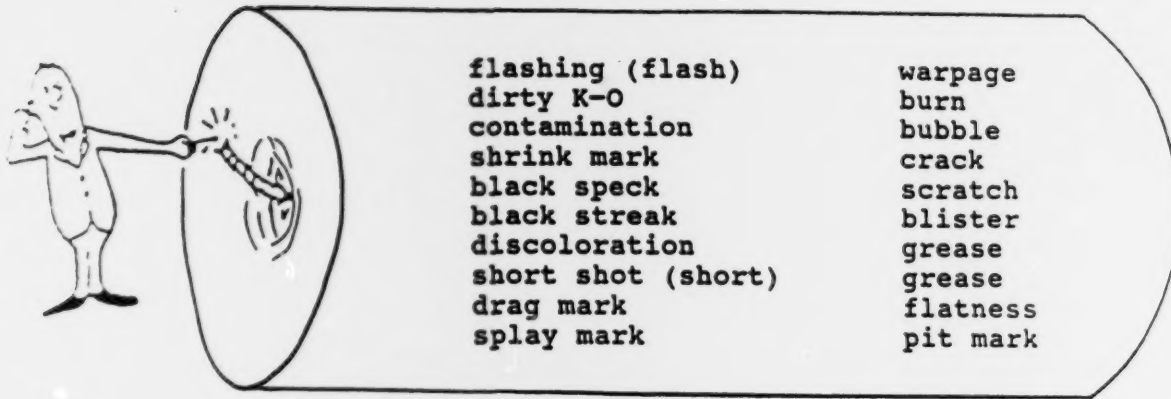
We have provided you with a sample activity using the list, "Everyday Objects". You can find this reproducible activity on page 28.

Since the items pictured are not ones we typically think of as plastic, we thought it would be interesting to use as a classroom activity. Try one of the following:

- > You can have students orally identify the objects
- > You can have students label the objects
- > Students can tell how the objects would be used in their own particular home situations

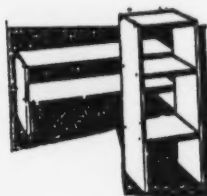


Common Defects

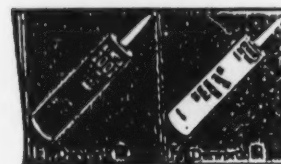
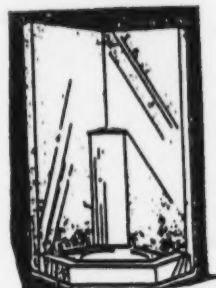


Each company has its own criteria for what constitutes a defect. It is important for you to find out which of the defects above are found at your worksite. Ask for examples to share with your students.

Everyday Objects



Horizontal or Vertical Storage Stackers
• All wood parts are of white melamine • Adj. shelves



10'x25' Clear or Black Polyfilm
• 3 mil. thick • Great as a dropcloth or weather protector • Durable linear plastic • Energy saving

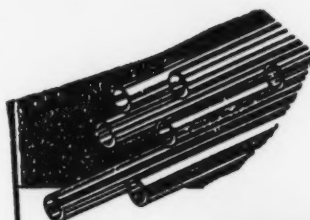


• For use on UPVC, PVC and ABS pipe & many household repairs

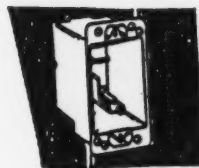
Insulation



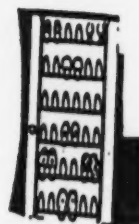
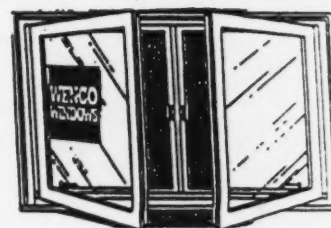
Kitchen & Bath Panel
• 4'x8' • Ceramic tile appears • Unique 6"x6" accent tile on accent tile contains floral dec.



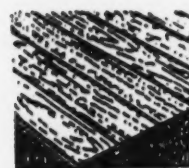
1-1/2'x10' PVC Pipe



Single Gang Old Work Box
• PVC 14 cubic inch capacity • Zip mount retainers



Over-Door Shoe Rack
• All steel construction • White epoxy finish • 15 yr. warranty • No. 3517W



OTHER MATERIALS

Take any form, check sheet, chart or graph, or other reading material (or find out what types of team activities students are participating in at the worksite) used by the company and ask these questions:

- > Is there any new vocabulary that is specific to the workplace that your students may not understand or be able to read?
- > Are there any words that carry a special meaning when applied to a workplace situation?
- > Are there any math calculations being used with which students may not be familiar?
- > Are there any concepts that students may not clearly understand?

If you answer yes to any of the previous questions, you have the beginnings for an activity that you can design specifically for your students.

In talking to supervisors and listening to conversations at the worksite, oral activities such as "Operators to Supervisors" on page 31 can be created. Look at the skill needs of your students and adapt the vocabulary and oral lessons accordingly.

THE INTERNATIONAL MARKET

If you are working in a company that deals in the international market, several classroom topics may prove useful.

- > The metric system and conversions may be used when shipping materials to other countries. You may want to find out how items are measured in order to provide relevant practice in your classroom.

For example, are weights of boxes being converted to metric system or visa versa? A good starting point for a unit on the metric system is to bring in sample boxes used by the company. Typically, on the bottom of the box are the dimensions in metric measure.

$$1 \text{ lb.} = 2.2 \text{ kg}$$

$$1 \text{ in.} = 2.5 \text{ cm}$$

- > Geography lessons can be an extension for international companies. Using a world map to learn where the company has different locations or where some of its key distributors are located would be of interest to your students.

This type of activity would also provide your students with a broader understanding of their company.



Operators to Supervisors

These are things operators need to say to their supervisors and things they need to understand when said to them:

OPERATORS:

- > The machine is down.
- > These parts are short.
- > These parts have flash.
- > These parts are burned.
- > These parts have dirty KO's (Knockouts).
- > This part has a black speck.
- > This part has black specks.
- > These parts have black specks.
- > This part is too light-colored.
- > These parts have grease.

SUPERVISORS:

- > What happened?
- > What's wrong?
- > What's the matter?

OPERATORS:

- > The grinder's stopped.
- > The grinder's stuck.
- spoons
- > The forks got stuck on the belt.
- knives
- spoons
- > The forks have dirty KO's.
- knives

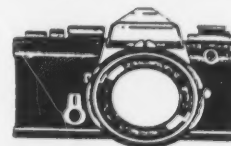
Source: Nancy Erb & Rosa Maria Ricci

TYPES OF CURRICULUM

VISUALS

Although we usually think of worksheets when we talk about curriculum development, we need to remember that there are many forms of curriculum. One excellent way to bring the workplace into the classroom environment is by using visuals.

If the company you are working in allows, try taking pictures of different situations - a worker operating a particular piece of equipment, a defective piece, safety signs. These pictures can be used to spark conversations and writing assignments.



Another form of visual is the video. Again, with your company's approval and support (It may be willing to pay for the development of the video itself!), you may want to design a video:

- > to explain prepositions (A video can show the difference among "put the paper IN the box", "put the paper ON the box", or "put the paper UNDER the box".)



- > to show direction ("Take a LEFT to go to the cafeteria.")

- > to develop vocabulary ("This is a RAMP.")
- > to show defects in a product ("Here is an example of FLASHING.")
- > to teach verbs ("The worker is now LIFTING the box.")
- > to show a process (A video could follow all the steps in creating a molded product, from pouring the pellets into the hopper to loading the truck for transporting. This would help students see the 'big picture' and better understand their role within the whole process.)
- > to illustrate safety procedures ("This is the correct way to hold a knife when taking off flashing.")
- > to provide work-related training (With your expertise as an adult educator, you can help the company simplify its training programs.)

If you are using a commercial video, the following format can be used in preparing you and your class to reap the greatest benefits.

VIDEO EXERCISE

1. View the video tape beforehand and look at it through your students' eyes.
2. What is the main message the video is trying to evoke?
3. Outline statements and questions - information bits you'd like the students to get from the video.
4. What vocabulary in the video might you teach before they view the video so that they do not miss the points you wanted to single out? Prepare a list of the vocabulary words and a worksheet for later use.
5. Show the video stopping at relative points to review what they have seen. Do the students have vocabulary lists in front of them to refer to if they forget?
6. Discuss the main point of view. Talk about specific examples that address the topic.
7. Give a worksheet testing how the vocabulary was used in the video. Can students give words or phrases that explain the vocabulary? Ask information questions about the points you want to single out.
8. Don't stop there. If you're working on a particular unit in grammar, i.e., conjugating verbs, why not conjugate the new verbs in the vocabulary of the video.
9. On another day, quiz them on definitions of the vocabulary. Start with fill in the blanks, matching, etc., if they are beginners. For advanced students, get the words and have them define them in English, not allowing them to give examples.
10. Another alternative - in a multi-level class, beginners must retell some points of the video by writing a few simple sentences about what they remember. The more advanced students must recap the video and express their opinions.
11. Relate any situation in the video to words, situations or issues happening in the company, to their families, or in their towns or communities.
12. Enhance listening skills by asking students what someone in the video said in response to a question or situation. How did the response relate to the discussion? Dialogue or indirect speech exercises and units could be used in these situations.
13. Have students answer the question: How does this video relate to our company?

ROLE PLAYING

Role playing is an excellent way to create a simulated work environment and reinforce vocabulary and concepts. How do you design effective role playing? The best way is to go down to the worksite, follow some of your students around for half a day, and note various situations and conversations. Now design a simulated role play that recreates similar situations you witnessed at the worksite.

Role playing can reinforce many concepts and skills, including the following:

- > model team activities
- > practice conversations with supervisors
- > simulate emergency and safety procedures
- > rehearse various company procedures - how to call in sick, how to ask for a day off

PUZZLES

Puzzles can be as simple as a fill-in-the blank worksheet to an elaborate crossword puzzle. Puzzles can serve as practice activities for those students who are always asking for more work. We have created two sample puzzles to get you started on your own ideas: "Plastic Word Search" and "Plastic Puzzle".

The "Plastic Word Search" can be used in a variety of ways. For example, it can be used for word recognition practice or oral vocabulary practice (instructor reads a word, student repeats the word, then finds the word using the annotated copy).

Crossword puzzles add variety to teaching vocabulary. They can be as challenging or as simple as you want - you are in control. Crossword puzzles not only help to reinforce vocabulary, they also serve as a means to practice problem-solving strategies. Students have to use various clues to discover missing information.

Follow the steps below to design your own crossword puzzle.

STEP 1: Begin by making a list of words you want included for review and reinforcement.

flashing burn

blister short

STEP 2: Look at the relationship between the words - are there shared letters?

flashing
short

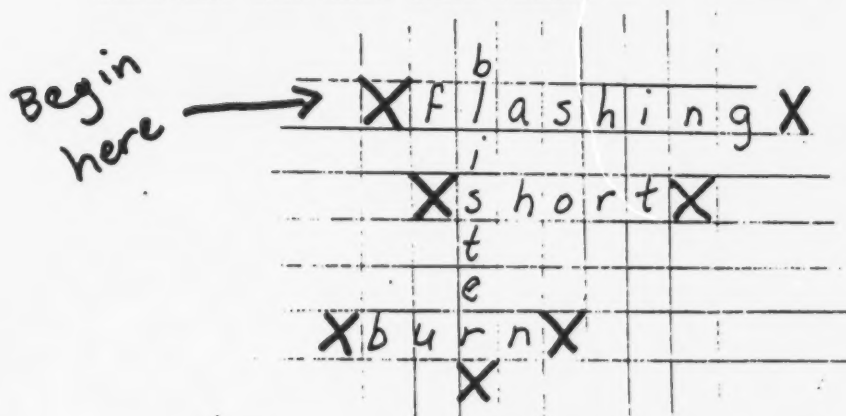
blister
burn

blister
flashing

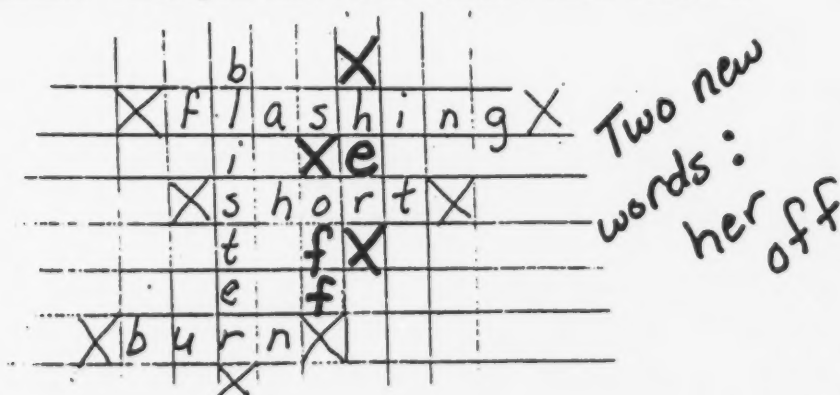
short
burn

flashing
burn

STEP 3: Place the words in a grid (Use accompanying template on page 39 or graph paper). Hint: Begin with the longest word/s and build from it. Be sure that you blacken in (or place a large X) each square after a word so the words will not run into each other.

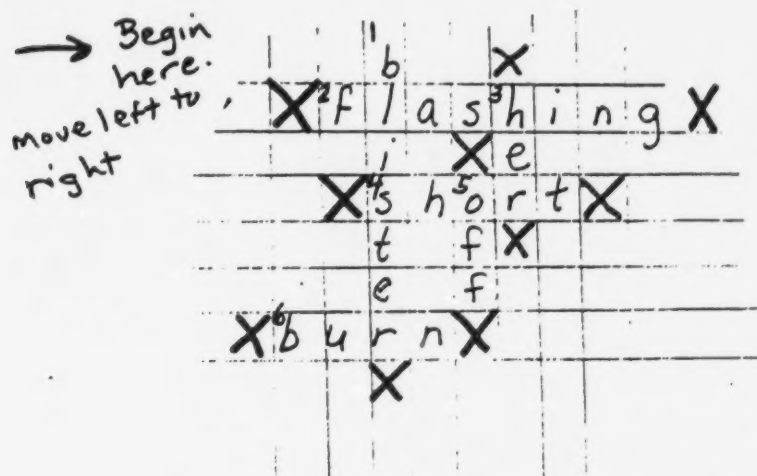


STEP 4: Once you have used all the words from your list, you may find you still have room for other words. This is a good time to throw in last week's review words or toss in a little grammar review. Look at your present configuration. Can you add some little word here or there?



STEP 5: Is your grid complete? The number of words you place in your grid will be dependent on the level of students you are dealing with. If you have a diverse class, you can begin with a simple grid, copy it, then add more words for more advanced students.

You now need to number your words. Move from left to right across the grid, going from top to bottom. For every square in the grid where you have begun a new word (either across or down), you need to place a number. A square where a word is beginning both across and down receives only one number.



Words Across:

2 flashing

4 short

6 burn

Words Down:

1 blister

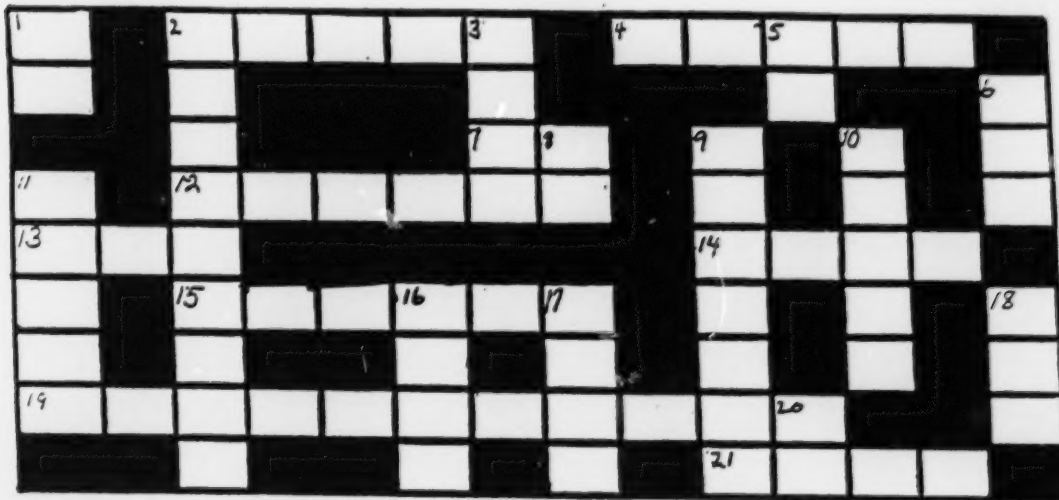
3 her

5 off

STEP 6: Now comes the "fun" part: provide a definition or fill-in-the-blank format for each word you have in your crossword puzzle. Definitions should correspond to the numbered words. All definitions for words reading across the puzzle should be listed as such; words reading down in the puzzle should be so labeled.

STEP 7: Make copies for all the students, provide an answer key, and enjoy!

Plastics Puzzle



ACROSS

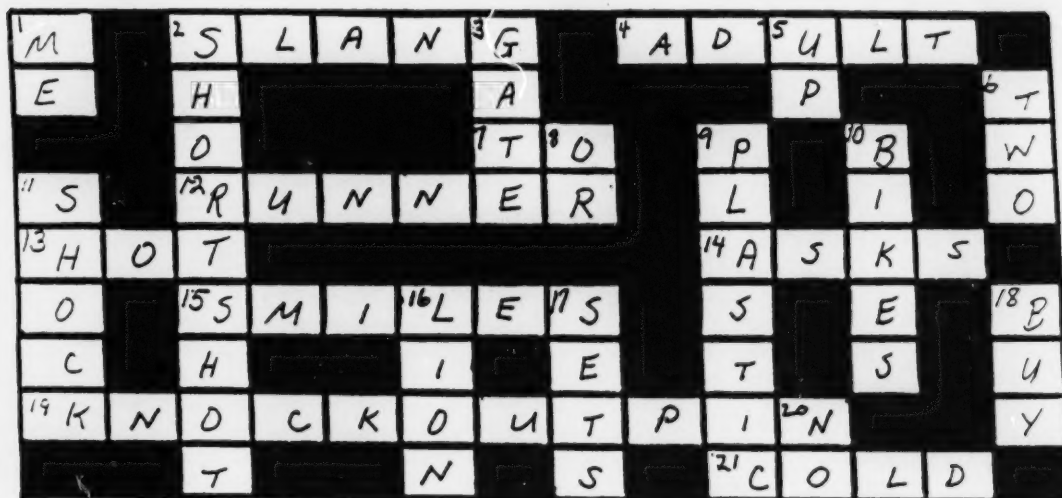
2. Not standard English
4. Not a child
7. Let's go ____ the store.
12. Channel that feeds material to the mold
13. Not cold
14. Requests information
15. Happy facial expression
19. Used to push the plastic item out of the mold
21. Not hot

DOWN

1. Personal pronoun
2. Result of not enough plastic in the mold
3. Point of entry into die cavity
5. Opposite of down
6. One + one is ____
8. Either/____
9. Synthetic material
10. Short for bicycles
11. Electrical surprise
16. Large jungle cat
17. Places an item on a table
18. Purchase
20. Opposite of yes

Source: Mikki Smith

Plastics Puzzle



ACROSS

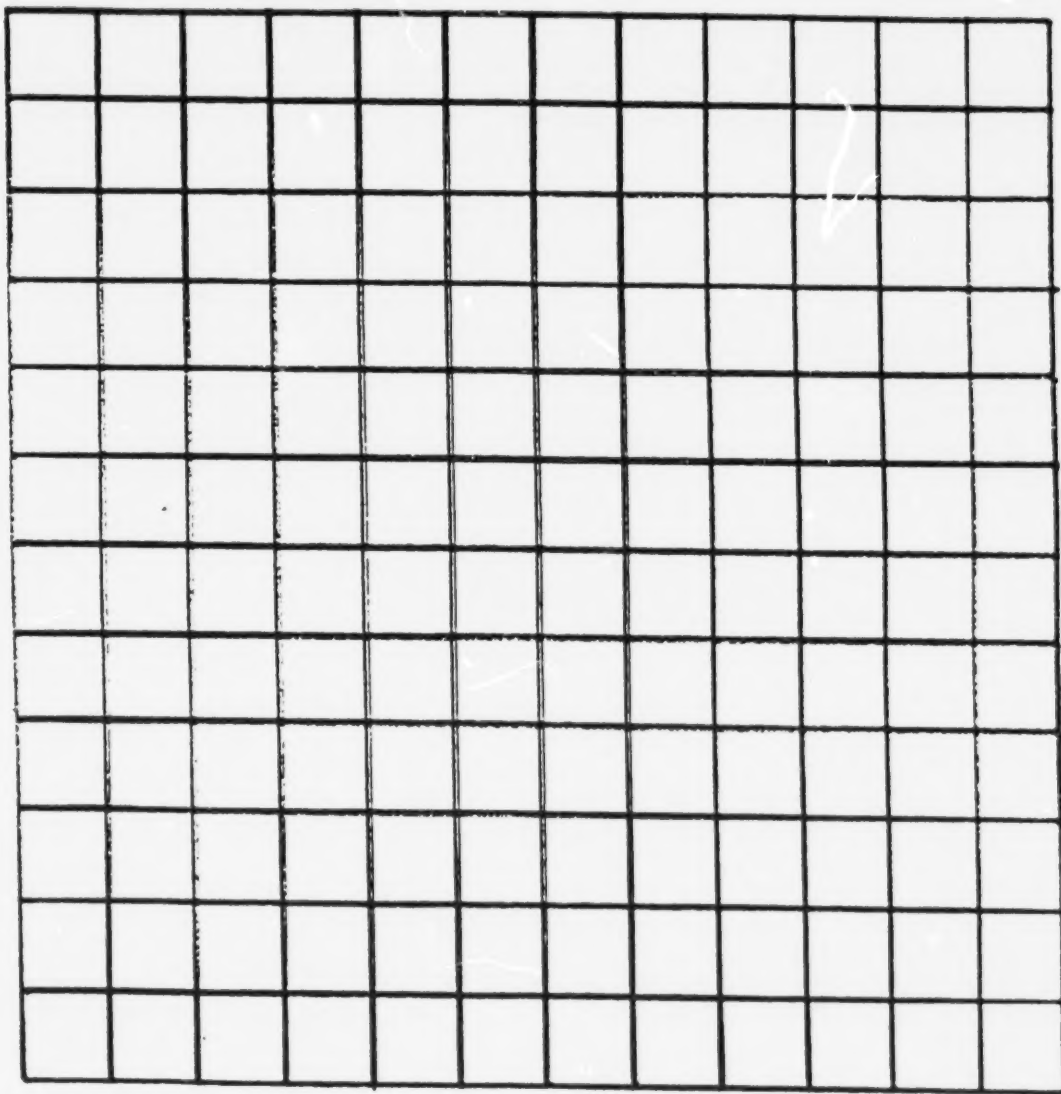
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17. Places an item on a table
18. Purchase
20. Opposite of yes

Source: Mikki Smith

Crossword Puzzle Template



Plastic Word Search

F	A	P	L	A	S	T	I	C	D	S
N	L	L	I	F	W	V	J	F	W	P
H	R	A	W	A	R	P	A	G	E	L
B	O	S	S	U	L	R	Z	E	L	I
O	B	T	V	H	H	U	U	K	L	T
C	L	I	M	B	I	N	G	A	T	M
C	D	S	C	H	T	N	R	D	I	O
O	P	I	X	G	I	E	G	Y	M	L
L	G	Z	E	T	B	R	U	R	E	D
D	H	E	A	T	E	R	B	A	N	D
S	O	R	T	C	E	L	U	C	K	S
H	P	J	M	D	Q	Y	B	K	X	H
O	P	S	N	B	I	K	B	O	E	O
T	E	I	V	U	L	E	L	M	H	T
N	R	C	I	R	D	I	E	T	Z	S
G	P	L	W	N	O	I	S	E	S	I
S	H	O	R	T	S	H	O	T	Q	Z
P	C	O	L	D	S	L	U	G	E	E
C	L	A	M	P	T	I	M	E	S	R

flashing

plastic

warpage

runner

bubbles

cold shot

hopper

hot

burn

PCV

sort

rack

die

mold

noises

grinder

blister

rating

boss

cold slug

clamp time

heater band

plasticizer

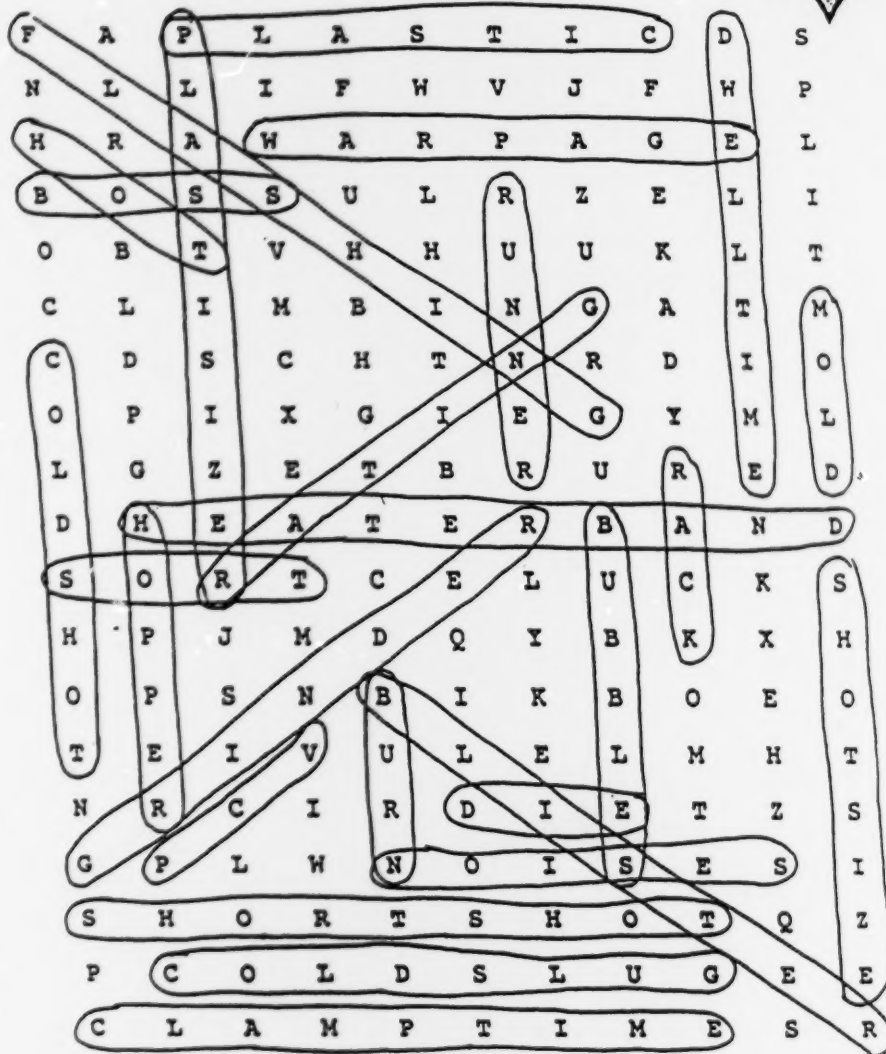
dwelt time

short shot

shot size

Source: Nikki Smith

Plastic Word Search



flashing

hot

mold

cold slug

plastic

burn

noises

clamp time

warpage

PCV

grinder

heater band

runner

sort

blister

plasticizer

bubbles

rack

rating

dwelt time

cold shot

die

boss

short shot

hopper

shot size

Source: Nikki Smith

PLASTIC SPECIFIC ISSUES

Workplace issues will vary from company to company as well as from job to job within a company. Although we have tried to provide you with some generic information about workplace issues specific to the plastics industry, it would behoove you to seek out key individuals who could support you in your efforts to learn about any issues specific to your environment.

FIRE

Because heat is used in making plastic products, safety issues related to fire could serve as a good introductory unit. A fire unit could include the following:

- > special vocabulary (including fire equipment and examples of fire hazards such as frayed wires and blocked entrance or exit)
- > types of fire extinguishers (How about getting the safety engineer to come into your class to facilitate the discussion?!))
- > methods of escape in case of fire
- > floor plans marking exits (A tour of the facility would work well here.)
- > emergency procedures (including how to treat burns, call in emergencies, put out a fire, and describe the location of the fire)
- > flammable materials



And what about skills? For the above unit on fire, you could include readings from safety manuals, signs, or relevant newspaper or magazine articles. You could present lessons on prepositions to describe where the fire is located. There could be a lesson on the difference between questions, statements, and commands - in an emergency you need to know how to command someone to do something. You could also include role playing to act out emergency situations.

On page 47 we have included an example of a worksheet on "Fire", developed after a classroom discussion of fire at the worksite as well as in the home.

SHIFTWORK

Shiftwork is often an issue in the workplace, especially in the plastics industry. Because it is more economical to run molding machines 24 hours a day, a plastics company may require two or three shifts of workers.

If you find your students bringing up the issue of shiftwork, it could prove advantageous for you to go ahead and address the issue -with the support of personnel. Your role as a workplace instructor is not to decide whether company policies are right or wrong, but to help students develop enough proficiency in their own communication skills so that they can discuss issues on their own.

Although you should be familiar with the company's policies after reading the Employee Handbook, it may be advisable to invite the personnel director into the classroom to lead a discussion on shiftwork. He or she would probably very much appreciate the opportunity to have your support in explaining why the company has developed specific policies.

You may want to do a mini-unit on shiftwork to include the problems related to shiftwork: fatigue, decreased efficiency, increased safety hazards, stress. (Here's a good time to get the company medical personnel involved.) Be sure to include in the discussion means of overcoming these problems.

SAFETY

Safety Contributors would be another useful unit for a plastics workplace. Contributors could include sickness and the impact this may have, not only on safety, but also on quality. The physical environment could significantly impact safety: Is there too much noise? Is the worksite cluttered or dirty? Are there offensive smells? The unit could be extended to include procedures for calling in sick, vocabulary development on body parts, and ways to maintain physical and emotional well-being.

If you decide to tackle a unit on safety, ask for support from the safety engineer. Also, be sure that you address what responsibility the employee himself has in making sure that he works in a safe environment. Don't present the issue in such a way that there is a negative perception regarding the company's role in safety.

The sample activity on page 48, "Safe or Unsafe" is an example of how one workplace instructor tackled a workplace issue and presented a reading lesson at the same time. A simple extension could be a discussion of what the prefix "un" means. What other words do you already know that begin with the prefix "un"?

SAMPLE MINI-UNIT ON DRESS CODES

The following mini-unit on Dress Codes was developed after the instructor realized her students were unfamiliar with the company's policy on wearing safety gloves and goggles.

Our purpose in sharing this mini-unit with you is for you to begin to see that communication skills - reading and writing (including grammar and mechanics), speaking, and listening, can readily be taught in the context of a work-related topic. Also, as you can see from this example, you can easily expand your lesson to life skills. Students can apply their new information not only on the job but also at home.

After an initial discussion about what a dress code is and what workers are required to wear, the following worksheet was designed:

What I <u>Have to</u> Wear at Work List the items you must wear before you enter your workplace. Why must you wear these? What is a "dress code"? What is the dress code at this company?	
--	--

Source: Jeannett Hoessel

Another activity included the practice on different types of clothing and material:

Jorges: My supervisor is Hernando. He is the handsome man in the plaid shirt.

Amanda: My supervisor is Dini. She is the neat woman in the polka-dot blouse. She heads the custodial staff.

Jose: That's my supervisor Frank. He's the man in the striped shirt. He thinks it's important for me to be here.

Phatahn: Mine, too. There's Ifran, the tall man with the mustache. He's wearing a blue and white checked shirt. He came to the U.S. from Poland.

Using the possessive, identify whose supervisors these are.



Describe your supervisor:

Yet another activity gave students an opportunity to review verb tenses and opposites:

I. Use a correct tense of the verb:

- (put on) 1. He _____ his tie now.
(dress up) 2. When she went to the party, she _____.
(try on) 3. He _____ his new suit every chance he gets.
(buckle) 4. He _____ his belt once he puts his pants on.
(unsnap) 5. _____ your jacket. It's too hot in here.
(wear) 6. She _____ those jeans almost every day.
(take off) 7. After she got home, she _____ her dress shoes and put on her slippers.

II. What's the opposite of these verbs?

button	_____
tie	_____
lace	_____
buckle	_____
snap	_____
zip	_____
dress	_____
loosen	_____
shorten	_____

Source: Jeannette Hoessel

An extension of this mini-unit included an activity where students had to design their own garments - a plaid skirt, a striped shirt - based on "design specifications" (an earlier workplace topic extensively discussed in the classroom).

Fire



1. In case of fire, dial _____.
 2. Spell your _____.
 3. Then say, I live _____
_____.
- Tell the problem:
My house is _____.
5. Use _____ to put out a grease fire.
 6. Use _____ to put out a wood
or paper fire.
 7. If someone's clothes are on fire, yell: _____,
_____, and _____.
 8. If you touch something that is too hot,
you can get _____.
 9. What safety equipment does the company provide
to protect you from burning yourself?

Source: Jeannette Hoessel

Safe and Unsafe



Observe: Look for unsafe acts and unsafe conditions.

Circle one

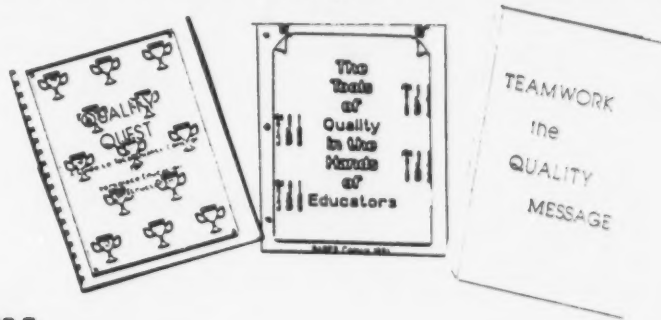
a damaged tool	safe	unsafe
a crane loading with four outriggers on a flat, firm surface	safe	unsafe
cutting with a utility knife away from your body	safe	unsafe
orderly work area	safe	unsafe
overexertion	safe	unsafe
using the head-to-toe check	safe	unsafe
tools and equipment in proper places	safe	unsafe
touching a hot surface	safe	unsafe
a forklift operator's wheels not chocked	safe	unsafe
a forklift operator shuts the propane valve	safe	unsafe
giving your full attention on the job	safe	unsafe
using improperly maintained tools	safe	unsafe
flying metal	safe	unsafe
a mushroomed head tool	safe	unsafe

Source: Jeannette Hoessel

WORKPLACE ISSUES

Not only are there plastic specific work issues, but there are other issues that an instructor involved in any workplace program should be aware of. Many of these issues revolve around quality and performance but may be called by different terms.

Quality Quest, Teamwork: the Quality Message, and Tools of Quality in the Hands of Educators go into greater detail about the various quality and team issues in the workplace. Therefore, we will only briefly refer to a few examples in relation to the plastics industry.



QUALITY TOOLS

There are probably three quality tools that you and your students should be familiar with in the context of the plastics industry:

- > the check sheet
- > the Pareto chart
- > the process flow diagram

Along with a brief explanation of what each is used for, we are including a sample of each. These samples will give you an indication of what to look for as you scrounge for materials in the work setting.

You will typically find that the check sheet and the Pareto chart (created based on the results of the check sheet) for the plastics industry related to defects. Since the molding machine manufactures the molded item, it is the responsibility of the worker to monitor that machine to make sure quality product is being produced. When a machine is producing poor quality, the worker documents the type of defect, or poor quality, on a check sheet. It is critical, therefore, that the worker, possibly your ESL student, is able to read each word on the check sheet as well as understand what each defect looks like in order to connect the defect to the written word. This is sometimes one of the most valuable classroom activities in the plastics industry.

CHECK SHEET EXAMPLE

Playphor Plastic Plant Reject Report

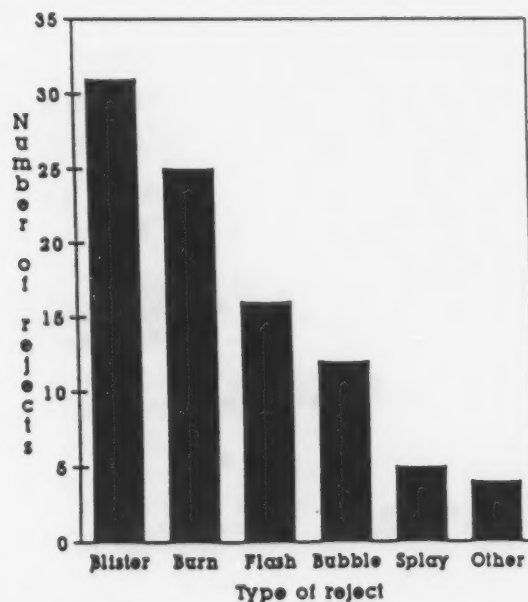
Date _____ Dept. _____
Machine # _____ Worker _____

Black streak	
Blister	
Bubble	
Burn	
Drag mark	
Flash	
Grease	
Scratch	
Splay	

PARETO CHART EXAMPLE

This Pareto chart is an example of what could possibly be created by a team working to eliminate the defects produced by a machine. The terminology here is the same as seen in the check sheet.

Playphor Plastic Plant Rejected Pieces

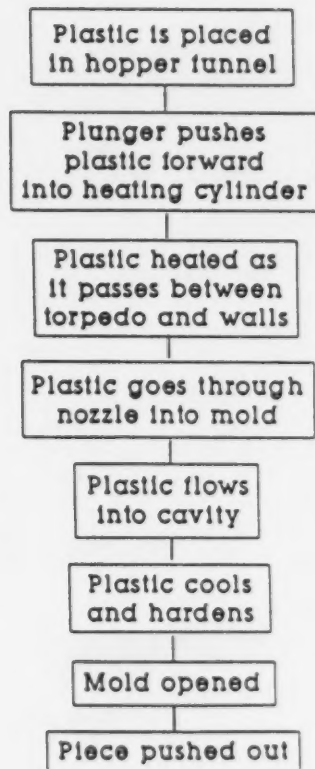


Week of 4 Jan 98

PROCESS FLOW DIAGRAM EXAMPLE

The process flow diagram, although not used as often by the worker as the check sheet, can serve as a much needed support for understanding the various molding processes. Instead of lengthy written directions on how a process works, a process flow brings clarity by using visuals along with simple explanations. If no flow chart exists for a molding process that your students are involved in, you may want to create one as a class project that could later be shared with the rest of the company.

Plunger Injection Molding Process Flow



TEAMWORK

A critical component of teamwork is communication. You could be a wonderful asset to the company by helping your students develop communication skills. Your students need to be able to explain concerns and describe situations orally, but they also need to have effective listening skills and basic writing skills.

If you are not sure where to begin developing a curriculum for your students, start with one of our lists. Better yet, follow your students around for the day and find out what kind of communication is going on. Build your curriculum activities around your findings.

Openly talking about concerns and issues of the company in a positive light can help establish a sense of teamness with your students. Encourage your students to become involved in the various initiatives occurring throughout the company.

Below is an example of how one teacher addressed the recycling issue in the workplace, giving her students not only a better understanding of what is involved in recycling, but also helping them develop a sense of pride and ownership in their company.

A SAMPLE MINI-UNIT ON RECYCLING

STEP 1 Contacted personnel to request a contact person in the company who could tell me about the company's recycling program.

STEP 2 Met with the Head of the recycling committee who invited me to join the group. We agreed to meet before she came to class so that she could fill me in on details and provide me with materials for my class. (She was very excited and receptive and had so much good information for me.)

She presented me with a general picture of what the company was doing now and what it hoped to do in the future.

We decided to start the classes on "Dr. Trash" video. This would give them an idea of how the general public feels about plastics. We then would show the class a video made by the company of the trash collected from the company to see where recycling wasn't occurring, what you can learn from studying trash, etc.



- STEP 3 Viewed the video once, then again to take notes.
- STEP 4 Reviewed the notes thinking about what points I'd want the students to remember. Then began grouping points into possible teaching units that could come out of the video, i.e., measurements, things in an office, what safety equipment is required, tools of the trade, scale, pounds, weight, questions to ask about weight, plastic products vs paper products, colors.....and the MYTH. Ended up with a discussion about local landfill problems and what some solutions might be (good subject for exercise in "Brainstorming").
- STEP 5 Throughout the weeks following the two viewings of the video (another after we had discussed it thoroughly), the terms, expressions, etc. were used in grammar units, and incorporated in the themes such as clothing units, measurement units, etc.

For example:

Change this statement into a yes/no question
1. The company sent its corrugated cardboard to the warehouse. _____
Answer: Did the company send its corrugated cardboard to the warehouse?

Note: Most students are familiar with the words they work with such as "corrugated cardboard". Most of them cannot spell them, and many do not pronounce them correctly. The repetitive use of these words corrects the pronunciation and sight word spelling.

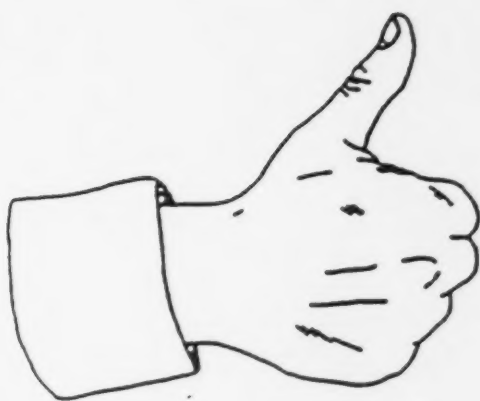
STEP 6 View the video with the class. So many lessons can come from this:

- > classification of objects
- > alphabetizing
- > counting
- > colors
- > description
- > amounts

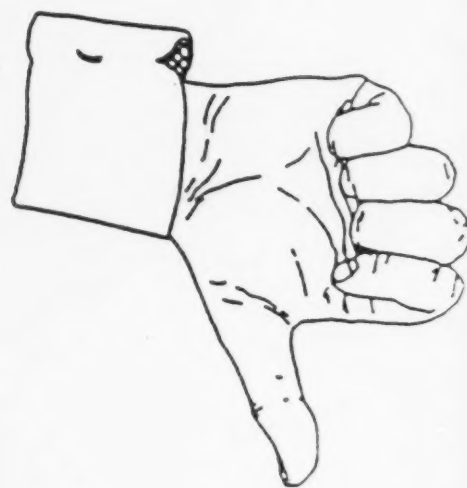
Examples:

- Write what you see. _____ _____ _____ _____ - List the verbs used. <table border="0"><tr><td>_____</td><td>_____</td><td>_____</td></tr><tr><td>_____</td><td>_____</td><td>_____</td></tr><tr><td>_____</td><td>_____</td><td>_____</td></tr></table> - Construct a paragraph about what happened in the video. Discussion Questions: - What is the purpose of viewing "Trash?" - What are some solutions to the problem? - What can we do here at the company and at home to help with recycling?	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____							
_____	_____	_____							
_____	_____	_____							

Source: Jeannette Hoessel



What Has Worked and What Hasn't



WHAT HAS WORKED AND WHAT HASN'T

Teachers have provided feedback on what has worked and what hasn't worked for them in workplace programs. They all stressed that information obtained from the company was an excellent source and could readily be used to provide a wealth of ideas from which curriculum could be developed. Plastics specific vocabulary, company forms, and general information can be used to develop lessons in all subject areas: math, English and reading. This allows the students to be able to immediately relate ideas and concepts learned in your classroom to their everyday life. Contrived situations taken from generic workplace books are not necessarily the materials, situations, and conversations they encounter on a daily basis.

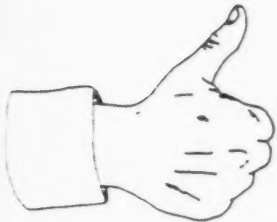
Teachers must talk to supervisors, department heads, key individuals, and students to discover the issues that are effecting their particular students. Plastic workplace students are adults, but the learning concepts are no different than with anyone learning to speak a new language, learning to read, or learning to perform mathematical calculations. It is the responsibility of the teacher to discover what the company is expecting, what the student needs to be able to do or say to function in the workplace, and then to develop materials which will address those needs.

Here are some ideas that have and have not worked.

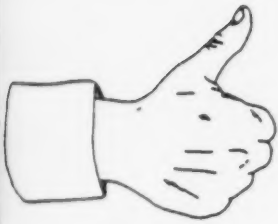
What Has Worked

- * Not having pre-conceived notions of what to teach
- * Using the company as a resource for ideas on what to address...

Personnel:



- > explain W-2 forms and income-tax withholding
- > health and benefits programs
- > talking to the boss
- > calling in sick
- > understanding time sheets and time clocks
- > reading pay-stubs



Safety:

- > safety regulations and equipment
 - ear plugs
 - gloves
 - goggles
- > fire prevention
- > safety specific vocabulary

Supervisors

- > quality control vocabulary, i.e.,
 - flash
 - burns
 - splay marks
 - grease
 - shot
- > filling out check sheets and reject reports

Students

- > things that need to be said to the supervisor
- > feed back on cultural differences
- > child care and transportation

Management Expectations

- > improve communication
- > ensure worker safety
- > enlist machine operators for 1st line QA (quality assurance)
- > prepare employees for promotion

* Workshops for supervisors

- > show supervisors how a new language is learned
- > provide techniques for them to use to ask for feedback
- > teach them that there is more than one technique to teach workers
- > give them ways to assure that workers understand

* What teachers need to know

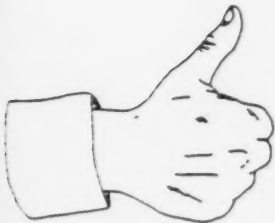
- > What is the real problem in communication????
 - lack of vocabulary?
 - noise is the plant?
 - speed of the speaker?
 - accent?
- > be knowledgeable of cultural differences and how problems can arise.

* Recruitment

- > word of mouth
- > teacher presence in the factory
- > supervisor referrals

* Program Content

- > have supervisors explain tasks and have one of the staff or teacher write it down
- > brainstorm with students which will generate many English sentences workers need to know
- > use company products and boxes to teach colors, codes, and item names
- > use workplace specific materials (company forms, etc)



-> non-traditional approach to teaching math,
reading, and English (grammar)

* Program Evaluation

-> Learning contracts that spell out what
supervisors expect to improve and what the
student expects to accomplish (with realistic
expectations)

-> Evaluation team consisting of

teacher

personnel representative

management representative

floor supervisors

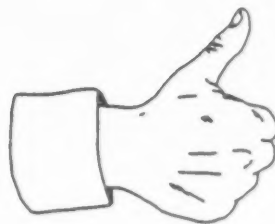
students

* Problems

-> day care

-> transportation

-> class availability for shift workers



What Hasn't Worked

* Materials/Program Content

-> non-workplace materials

Research has shown that using the functional context approach is more effective and relevant than depending on a more generic curriculum approach

In performing task analyses, it is more effective and the information more pertinent when teachers talk to supervisors and managers about what workers need to know.

-> forms for supervisors/management to complete asking for overall view or explanation of what workers at certain jobs must do (task analysis)

-> standardized curriculum

Workplace programs, the classrooms, the teachers, the needs, and the students are all non-traditional. We must look to alternative methods of meeting workplace needs.

Workplace education is unique. It is dynamic, continually evolving to meet the ever-changing needs of the goals of the students and company.

-> traditional approach to subject matter

-> programmed instruction

It is preferable to use as support rather than a stand-alone. Workplace students need positive personal interaction.

* Recruitment

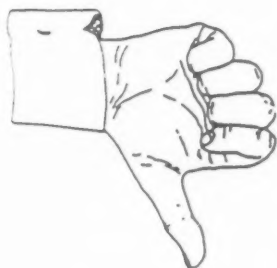
More effective methods include teacher presence at the worksite, word-of-mouth, and supervisor referrals.

-> signs advertising the program in native languages

* Evaluation

-> standardized testing

How can a standardized assessment tool be used to evaluate the results of a customized, non-standardized, non-traditional program or curriculum?!





Glossary

Glossary

ABS - (Acrylonitrile butadiene-styrene) - A thermoplastic which is tough, hard, impact resistant, and resistant to chemicals. Use for tote boxes and trays, safety helmets, and for pipes which carry chemicals.

Acrylics - Thermoplastics prized for crystal clarity and resistance to weather and impact. Scratches easily. The commonest member of the acrylics family is better known as "Perpex".

Active Cavity - A cavity in a mold that is not blocked off and is able to produce the article for which it was designed.

Baekeland - A Belgian chemist who developed phenolic (phenol-formaldehyde) plastic called Bakelite used to make insulators, bobbin ends, distributor caps, and other auto ignition parts.

Bakelite - Phenolic plastic developed by Dr. Leo H. Baekeland in 1909.

Black Speck - Considered a defect in making cutlery. It signifies that a foreign substance may be mixing with the plastics..

Blister - A type of defect. A bubble forms and then pops on the outside of the mold.

Blow Molding - A process of forming hollow objects from thermoplastics.

Bubble - A type of defect generally seen inside of clear molded plastic part (such as toothbrushes or handles).

Calenders - A method of making a continuous sheet of plastic. Material is first softened by heat and then passed between two or more rollers under great pressure.

Cavity - The hollow portion of the mold that forms the shape of the plastic article to be produced. The cavity is filled with molten plastic.

Cellulosics - Thermosetting plastic which is flexible and tough. Used to make photographic film, plastic cements, and lighting fixtures.

Clamp Pressure - The pressure that is used to keep the two halves of a split cavity mold together. This can be done in three ways:

= Hydraulic Clamp - uses hydraulic fluid and pistons to close the halves of a mold.

= Pneumatic Clamp - uses compressed air and pistons to bring the halves of the mold together.

= Toggle Clamp - a mechanically assisted system that closes the halves of the mold.

Clamp Time - The amount of time that the mold halves are kept together.

Cold Shot - A cavity on a mold that is used to balance the runner system. See Cold Slug.

Cold Slug - A cavity that is machined into the mold that is used to balance and control the flow of plastic into the "active" cavities of the mold.

Compression Molding - A process that compresses plastics materials into shape. The materials are cured or hardened in a metal mold. Articles made include light-switch cover plates, plastic dishes, and toaster handles.

Cure - The time required for a material to stabilize after transitioning for one state to another.

Die - An opening through which heated plastic materials are forced during the extrusion process.

Dirty K-O (Knockout) - A defect on cutlery. It is the spot on the piece of plastic where the knockout pin has pushed the item out of the mold.

Dwell Time - The time a mold is kept closed after the plastic material has been injected.

Epoxy Resins - Thermosetting plastics which are extremely tough and resistant to heat. The most outstanding characteristic is their ability to form strong adhesive bonds between a wide variety of surfaces, including wood and metal.

Extrusion - Process by which plastic is made into long, continuous shapes such as garden hoses, soda straws, and plastic rods.

Flash (also known as Flashing) - Plastic material which escapes or exudes at the parting lines of the mold during the molding process. Can be considered a defect when not removed.

Fluidized Bed Coating - A process that uses dry powdered plastic materials to coat objects. Example of this is coated lawn furniture. The plastic coating is more durable than paint.

Friction Welding - Frictional heat is used to join two pieces of plastic together. One piece is held still while the other is rotated at a high speed. The friction between the two pieces generates heat which bonds the parts together.

Foams - Through an expansion process plastic material is expanded in a mold. Foams are formed. Foams have a spongelike structure and can be molded by extrusion, injection, and compression processes. Thermoplastics and thermosetting plastics may be foamed.

Both rigid and flexible foams are produced. Rigid foams are used to make items like boat flotation cells and furniture frames. Flexible foams are used for sponges, furniture padding, mattresses, and dashboards for automobiles. One of the most widely foamed plastics is polystyrene (Styrofoam).

Gate - The narrowing between the runners and the cavity.

Grinder - A machine that "chops" the ejected gate and runner system into pieces that can be reused (recycled) in the injection molding process.

Hardness Test - A standard test that drops metal styluses of different shapes onto dishes that have been molded out of the material to be tested. Observations made of the impression left by the styluses determines the hardness.

Heater Bands - Heating elements that are located around the barrel of the injection molding machine. The bands are typically located between the hopper and the nozzle. They help soften the raw plastic material.

- > In plunger injection molding machines the heater bands do most of the work.
- > In screw injection molding, the heat is primarily generated by the friction created as the screw moves the plastic material forward from the hopper into the cylinder.

Heating Cylinder - Cylinder where raw plastic material is heated during the molding process.

Heat Staking - A process where preheated metal fastening devices are inserted into a plastic component under pressure.

Heater Tool Welding - A process in which two pieces of plastics to be joined are heated by being placed in a preheated metal tool. They are fused together and allowed to cool.

Hopper - A funnel shaped mechanism that is used to accept plastic pellets into the injection molding machine.

Injection Pressure - The pressure under which the molten plastic is injected into the mold cavity.

Interface - Line where two halves of mold meet.

Izod Notch Test - A standard test that uses a plastic bar with a 27° notch cut into it to measure the impact strength of plastic materials.

Knock-out Pins - These pins are used to eject the plastic article from the mold. These are sometimes called "ejector pins."

Laminating - A process which uses layers of plastic materials or plastics combined with other materials to form products. It includes high- and low-pressure lamination. Low-pressure laminated products are made from fiberglass or thermoplastic sheets. High-pressure lamination can be divided into two groups:

- > high-pressure fiberglass lamination
- > high-pressure thermosetting lamination

Melamine - Thermosetting plastic valued for its transparency and extreme resistance to scratches. Think of Melmac dishes.

Milling - A machining process that shapes metal by cutting with an end-mill bit. An end-mill bit is similar to a drill bit, but it has no point.

Mold - A device that is used to produce consistent plastic components of desired shape and size.

Nozzle - Where hot plastic enters into the sprue.

Nylon - A thermoplastic which was first discovered as a result of planned research. In 1934, W. H. Carothers, an American chemist, led a team of researchers in discovering a substitute for silk. Nylon can be injection molded, extruded as a film and blown into bottles. It is difficult to ignite and has a variety of uses from stockings, to drip-dry shirts, to tents, gears, latches, and toothbrush bristles.

Operating cylinder - Moves the plunger back and forth in the plunger injection molding process.

Phenolics - A thermosetting plastic which has good high temperature resistance. Often used for electric frying pan and iron handles.

Plasticisers - Chemicals which when mixed with a polymer are able to get in between the chains of molecules and force them apart. Plasticisation makes plastic materials more workable. Camphor was one of the first.

Plating - A process that is used to protect the cavities of a mold from corrosive gases produced during the injection molding process. Many molds are nickel plated to protect them from the hydrochloric gases produced from molding PVC.

Plunger - Device used in plunger injection molding which pushes raw plastic material into the heating cylinder. It is driven by the operating cylinder.

Polycarbonate - A thermoplastic which is a hard, rigid material, with high impact strength and a high softening point. Used in tail light lenses.

Polyester - A thermosetting plastic which is used to describe a whole range of materials. The thermosetting polyesters are widely used with glass-fiber reinforcement. Boat hulls, fishing rods, vaulting poles, lacquers for furniture, and fabrics are examples.

Polyethylene - A thermoplastic which has the same properties as Teflon, but melts at a much lower temperature.

Polypropylene - Thermoplastic similar to polyethylene but harder and more resistant to heat.

Polystyrene - A thermoplastic almost unique among plastics because of the metallic ringing noise which occurs when it is dropped on a hard surface. Used to make screw caps for bottles. Polystyrene foam is used to make Styrofoam.

Polyurethane - Thermoplastic used for its cushioning ability.

PVAC (polyvinyl acetate) - Thermoplastic which is an important component in adhesives, paints, and fillers. Often chemically combined with PVC.

PVC - A thermoplastic from which a wide variety of items are made: light weight plastic raincoats that pack away in your pocket, plastic shower curtains, hard and rigid gutters and downspouts, even the molded trays in boxes of candies. This difference in properties is a result of plasticisation which makes PVC more workable.

PVDC (polyvinylidene chloride) - Thermoplastic which remains strong even when extremely thin. An example is Saran Wrap.

Roll Forming - A group of processes in which plastic is formed using rollers. The sheets may be backed with a "substrate" (fabric, paper, or fiberglass material) or they may be unbacked.

Runners - Narrow channels which convey the polymer (plastic) from the sprue to the cavity.

Short Shot - This usually occurs when a mold cavity is inadequately filled. This can be caused by too small a shot size, inadequate injection pressure, or shortened plunger travel. It is considered a defect.

Shot Size - The amount of plastic required to adequately fill the runner system and cavities of the mold.

Spin Welding - The process in which plastic components, usually of similar material, are spun together under pressure. Friction occurs, causing heat that softens the pieces allowing them to form a bond.

Splay Marks - Irregular cloudy lines found on the surface of injection molded parts. These marks are usually caused by plastic that has not been heated enough or a mold that is too cold. Considered a defect.

Split Cavity - A type of cavity that splits in two. It holds a solid molded object such as a ball.

Sprue - Fits tightly against the nozzle and carries plastic into the mold.

Staking - A process where metal thread-like fastening devices are pressed into plastic components.

Teflon - A thermoplastic fluorocarbon which is low in friction (slippery). Used to coat cookware electric irons, saw blades, etc.

Tensile Strength - Tests the ultimate physical property of a plastic material by pulling a dog-bone shape article of the test material apart. The strength of the material is measured in inch - pounds.

Thermofusion - Means "heat fusion". The melting and sticking together of plastics using heat.

Thermoforming - A process which uses hot plastic sheet or film stock. The sheet or film is formed over or into a mold by vacuum, air pressure, or mechanical force. There are two types of vacuum forming: drape forming and cavity forming.

Thermal Sealing - The simplest method of sealing plastic parts, as well as being the least expensive and most popular.

Thermoplastics - A family of plastics which when heated make a physical change. They can be softened and hardened many times. Examples of thermoplastics are acrylic, fluorocarbons (Teflon), polyethylene, polypropylene, polystyrene, and PVC.

Thermosetting plastics - A family of plastics which are cured or set by heat or heat and pressure. They undergo a permanent chemical change during molding which does not allow them to be recycled or softened again.

Examples of thermosetting plastics are epoxy, phenolic, polyester, and silicone.

Torpedo - A mass of metal used to push raw plastic material against the wall of the heating cylinder during molding.

Ultrasonic Staking - A welding or bonding process using ultrasonic waves. Energy is generated by the ultrasonic sound waves and used to weld plastics. Mechanical vibrations are transmitted through the plastics material to the joint (interface). Mechanical energy is converted to heat at the joint producing an instantaneous weld.

Vacuforming - A method of thermoforming.

Warpage - A type of defect where the molded plastic is not correctly shaped. Acceptable warpage will vary from company to company.

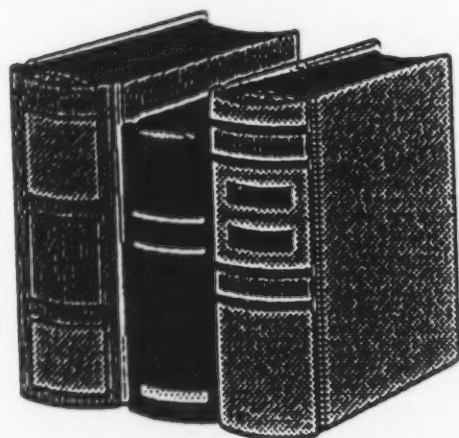
Welding - Methods used to join two or more moldings.
Examples include:

ultrasonic staking

frictional welding

thermal sealing

G-7



Resources and Appendix

LISTED RESOURCES

Another Look At Plastics

1992, American Plastics Council

A booklet available free of charge. Call 1-800-PLASTIC

Basic Industrial Arts - Plastics

Dr. Gerald L. Steele, Dr. Wilbur R. Miller, Dr. Marion E. Maddox,
and Lavon B. Smith

McKnight Publishing Co., 1978

ecoLOGICALLY SPEAKING, May 1992

"Committee Voices Opposition To MassPRIG's Packaging Ban
Legislation"

A quarterly newsletter published by the NYPRO Environmental
Committee

Giant Molecules

Morris Kaufman

Doubleday Science Series, 1968

Intoduction to Plastics

J. H. Briston and C. C. Gosselin

Newnes Books, 1968

Opportunities in Plastics Careers

Jan Bone

VGM Career Horizons, 1991

Plastics: America's Packaging Dilemma

Nancy Wolf and Ellen Feldman

Island Press, 1991

Profiles of NYPRO

Bill Coulter

Davis Press, 1990

Recycling

Jerome Goldstein

Schocken Books, 1979

WCBS-TV Video, Saturday Night Live with Connie Chung

Segment on "Dr. Trash" (William Rathje)

Working with Plastics

Time - Life Books, 1982

NYPRO WORKPLACE EDUCATION
PROGRAM DESIGN / PHILOSOPHY

THE WORKPLACE EDUCATION PROGRAM AT NYPRO, INC. IS
DESIGNED TO INCORPORATE THE GOALS OF BOTH THE COMPANY AND
THE STUDENT / EMPLOYEES.

NYPRO'S GOALS

Employees develop Basic Skills (proficiency in spoken and written English, Reading, and Math) to a degree that they are able to

1. Function more comfortably and more efficiently on the job
2. Comprehend and follow safety procedures
3. Read and comprehend manual for Inspector - Packer Training

STEPS TO ACHIEVING GOALS :

GOAL # 1

Basic Skills

1. Instruction in Basic Reading Skills - phonics, syllable division, comprehension
2. Instruction in Basic Math Skills - addition, subtraction, multiplication, division, fractions, percents, decimals

English as a Second Language

2. Familiarization with workplace vocabulary
3. Instruction in conversational and written English (conforming to standards of correct English usage) pertaining to workplace situations
 - A. Duties on the job
 - B. Previous work experience

- C. Formulating questions about routine tasks and instructions
 - D. Asking supervisor or co-worker for help
 - E. Giving excuses for lateness or absence
 - F. Explaining a technique or operation of a piece of equipment to a co-worker
 - G. Reporting and describing the nature of problems on the job
 - H. Reading and understanding work memos
 - I. Teaching a routine task to a co-worker using step by step verbal instructions
 - J. Asking about benefits
 - K. Asking about regular paycheck deductions and questioning irregularities
 - L. Interpreting employee review forms
3. Familiarization with employee's responsibility to the company, the company's responsibility to the employee, and the opportunity for employee to advance to a better position, qualify for higher training, or achieve recognition
- A. The Nypro Commitment
 - B. Company Rules and Regulations
 - C. Employee Evaluation Procedure
 - D. Nypro Institute offerings
 - E. "A-Team" Recognition Program

GOAL # 2

- 1. Familiarization with safety vocabulary
- 2. Instruction in conversational and written English pertaining to safety commands and expressions
 - A. Responding to simple oral warnings or basic commands about safety
 - B. Reading common warning or safety signs at the work - site
 - C. Reading written safety regulations and operating instructions for equipment

GOAL # 3

The language in the Inspector - Training Manual is of a highly abstract nature and on an advanced level. It would be deemed appropriate only to those students who have progressed through Goals # 1 and 2.

STUDENT / EMPLOYEE GOALS

Through a questionnaire, the student / employee goals in the following areas are measured :

- A. Employment goals
- B. Educational / Training Goals
- C. Program Goals